FACTORS THAT INFLUENCE AND PREDICT UNDERGRADUATE NURSING AND PARAMEDIC STUDENTS' INTENTION AND USE OF EVIDENCE-BASED PRACTICE

MARY-ANNE RAMIS

RN BN Grad Cert (Infection Control) MPhil (Clinical Sciences)

Supervisors:

Professor Anne Chang

Professor Lisa Nissen

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Abstract

Background: Undergraduate healthcare students have different influences on and motivations for learning and implementing EBP compared to postgraduate students and health professionals. Nevertheless, for many health disciplines, undergraduate students are now required to incorporate evidence-based practice (EBP) into their clinical decision-making and professional practice, as mandated by registration requirements. Previous research relating to EBP has predominantly focused on health professionals and on changing their behaviour to improve evidence implementation, rather than instilling and developing positive EBP behaviours in the first instance. Current EBP education research for undergraduate students provides limited evidence that students are confident with or intend to implement evidence in their practice upon graduation. Based on Bandura's self-efficacy theory, this research investigated factors influencing and predicting undergraduate health students' intention to use EBP as well as their current use of EBP during their undergraduate course. In consideration of reports of low EBP implementation, the purpose of this research was to contribute to filling the gap in knowledge of factors influential to successful learning and subsequent intention to adopt EBP by newly graduated students across different disciplines.

Objective: The objective of this exploratory study was to use a theory-based framework to investigate factors influencing and predictive of undergraduate health students' intention to use evidence-based practice in their clinical fields after graduation as well as current use of EBP during the course of their degree.

Method: The study was conducted in two stages. Firstly, a systematic review was undertaken to synthesise available research on undergraduate health student's intention to use EBP. A protocol outlining inclusion, exclusion criteria and methods of the review was registered on the Prospero international prospective register of systematic reviews. For the second stage of the research, factors identified from the systematic review, the available literature and Bandura's self-efficacy theory were used as variables for developing and testing two multivariate prediction models. The outcome of interest for the first model was undergraduate students' intention to use EBP after graduation. The second model explored factors influencing undergraduate health students' current use of EBP. Using an online survey, comprising tools measuring factors within the hypothesised model, two episodes of data collection were undertaken from nursing and paramedic students from one metropolitan university in Brisbane, Australia. Data from first and/or second year students were collected for the first episode and used to fit the prediction models. The second episode of data collection aimed to validate the models and comprised responses from third and/or final year undergraduate students.

Results: The systematic review identified three papers for inclusion, one from the field of social work and two from nursing. Although the overall evidence was weak to moderate, the review identified factors of EBP familiarity, EBP attitudes, perceived capability beliefs (self-efficacy), and learning support within academic and clinical environments, as influential to student intention to use EBP. Confidence and preparedness for clinical practice were also identified as having some influence on the outcome.

For Stage 2 of the research, the first episode of data collection resulted in 162 complete responses from first/second year nursing and or paramedicine students. The data were subsequently used to test the fit of the hypothesised prediction model. Student EBP beliefs was the only variable to have direct influence on student's Intention to use EBP ($\beta = 0.50$). The developed model demonstrated a good fit ($\chi^2 = 9.04$, d*f* = 6, p =0.171; GFI = 0.982; AGFI = 0.936; SRMR = 0.0451; RMSEA = 0.046). Despite a much smaller sample size in the second data collection episode for validating the model (n = 48), analysis using bootstrapping techniques identified EBP beliefs again being the most significant factor to predict undergraduates' intention to use EBP. The validated prediction model identified 18% of variance in intention to use EBP as being explained by direct and indirect relationships between predictor variables which included EBP beliefs, Sources of EBP self-efficacy, EBP self-efficacy and Current EBP use.

A second model developed and validated for factors influencing undergraduate students current EBP use, identified Sources of EBP self-efficacy, EBP self-efficacy and EBP beliefs as having direct and significant influence on current EBP use. The tested model with direct and indirect relationships between variables of EBP self-efficacy, EBP beliefs and Sources of EBP self-efficacy explained 50% of variation of current EBP use. Model fit indices suggested a good fit to the data ($\chi^2 = 5.275$, d*f* = 3, p = 0.153; GFI = 0.987; AGFI = 0.936; SRMR = 0.022; RMSEA = 0.069). The validated model, using data from the second episode of data collection was poorer fit but still explained 60% or variance for current EBP use ($\chi^2 = 7.321$, d*f* = 3, p = 0.062; GFI = 0.945, AGFI = 0.727; SRMR = 0.794, RMSEA = 0.175). In the validated model that was fit with data from students in their latter years of study, a non-significant path was identified from Sources of self-efficacy to EBP self-efficacy.

Discussion: The findings from testing and validating the prediction model for factors influencing undergraduate health students' Intention to use EBP, highlight the need to foster positive EBP beliefs in undergraduate students if they are expected to utilise EBP skills in their clinical practice after graduation. Thus, it is proposed that delivery and content of EBP curriculum for undergraduate students has critical influence on student's intention to use EBP in their practice after they graduate, through fostering beliefs that EBP is relevant, achievable and of benefit to patients. For current EBP use, EBP beliefs, Sources of EBP self-efficacy and EBP self-efficacy are all influential to students using EBP during their degree. Students rely on sources of self-efficacy such as verbal feedback, positive role modelling, mastery experiences and emotional awareness of their own reactions during learning EBP. However, a non-significant relationship between Sources of EBP self-efficacy and EBP self-efficacy for students in their latter years suggests although students are receptive to ways to build their EBP self-efficacy actual extent of their EBP self-efficacy, particularly for use of EBP is lower at that stage of their degree. This finding further supports the few studies available regarding student levels of EBP confidence and their EBP behaviours, closer to graduation.

Conclusion: This study identified several factors influential to undergraduate health student's intention to use EBP in their clinical fields after graduation. Bandura's self-efficacy construct supports building EBP development thus incorporating theory-based strategies within curricula to promote EBP self-efficacy are encouraged.

Supporting positive EBP beliefs throughout the degree course increases students' intention to use EBP after graduation and inclusion of Sources of self-efficacy in EBP curriculum has potential to increase student use of EBP, although further research is required to identify challenges facing students at the latter end of their course. Sustained EBP beliefs and behaviours could be influenced by allowing time for students to master skills and observe positive EBP behaviours and subsequent patient outcomes. More research is recommended in different disciplines and with larger samples to test the generic capability of the model of factors influencing undergraduate students' intention to adopt of EBP following graduation.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

EBP	Evidence-Based Practice
EBM	Evidence Based Medicine
EBHC	Evidence-based health care
RCT	Randomised controlled trial
SCT	Social cognitive theory
SE	Self-efficacy
EFA	Exploratory factor analysis
CFA	Confirmatory factor analysis
SEM	Structural equation modelling
GFI	Goodness of Fit index
CFI	Comparative fit index
NFI	Normative fit index
RMSEA	Root mean square error of approximation
RMR	Root mean residual
SRMR	Standardised root mean square residual

Statement of Original authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

QUT Verified Signature

Signed:

Date: July 10, 2017

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Chapter 1: Introduction

"If you wish to understand a culture, study its nurseries."

Erik Erikson (as cited in Shulman, 2005)

1.1 Background

Undergraduate students across many health disciplines are required to incorporate evidence into their clinical practice upon graduation or registration (Brown, Kim, Stichler & Fields, 2010; Ciliska, 2005; Dawes et al., 2005; Fineout-Overholt & Johnston, 2005; Fineout-Overholt, Levin, & Melnyk, 2004; Forsman, Wallin, Gustavsson, & Rudman, 2012; McEvoy, Williams, & Olds, 2010; Nursing and Midwifery Board of Australia, 2016; Paramedics Australasia, 2011; Rycroft-Malone, 2006; Tilson et al., 2011). Consequently, educators are in a position to facilitate students' learning of evidence-based practice (EBP) in a manner that enables them to become confident EBP practitioners. Despite such requirements, the discourse around EBP has historically focused on changing clinician behaviour in their respective fields to adopt EBP practices (Eccles et al., 2006; Grimshaw et al., 2001; Grimshaw, Eccles, Walker & Thomas, 2002) Hence, it is not clear how or if undergraduate students feel capable of meeting such EBP criteria, as new health professionals.

The initial focus of EBP education for health professionals was aimed at developing skills and knowledge, with a goal of improving evidence implementation within respective clinical environments. For undergraduate students, EBP skills and knowledge alone may be inadequate preparation for meeting registration EBP requirements on completion of their degree (Artino et al., 2012; Ciliska, 2005; Florin, Ehrenberg, Wallin & Gustavsson, 2012; Ilic, 2009; McEvoy et al., 2010; Spek, Wieringa-de Waard, Lucas, & Dijk, 2013a). Evidence suggests integrating EBP into clinical curricula rather than teaching it as a separate subject or unit is more effective to facilitate evidence use in practice (Coomarasamy & Khan, 2004; Dawes et al., 2005; Tilson et al., 2011; Young, Rohwer, Volmink, & Clarke, 2014). However, research to support this has been conducted primarily in postgraduate populations or a mixture of student and health professionals (Young et al., 2014) therefore extrapolating results to undergraduate students may not be appropriate. Additionally, continued low evidence implementation rates (Grimshaw, Eccles, Lavis, Hill & Squires, 2012; Straus, Tetroe & Graham, 2013; Graham et al., 2006) suggest barriers still exist between learning about EBP and the complexity of translating EBP knowledge into clinical practice across all practitioner and student levels.

In spite of general agreement and growing acceptance across disciplines of the fundamental steps of the EBP process (Dawes et al., 2005; Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996), the literature presents a segregated, discipline specific approach to undergraduate EBP learning and teaching (Bellamy et al., 2013; Satterfield et al., 2009). This has resulted in repeated and at times, inconsistent reporting of fundamental concepts of EBP education within individual disciplines (Phillips et al., 2014). Recommendations exist for teaching EBP in an inter-disciplinary manner (Greenhalgh, Howick & Maskery, 2014; Satterfield et al., 2009; WHO, 2010) with the WHO suggesting intercollaborative education is an essential step in preparing practitioners for realities of professional working environments

(WHO, 2010). Teaching EBP to undergraduates in an interprofessional context would align with such recommendations.

Back in 2005, the Sicily statement on evidence-based practice was published after a consensus process of 86 international delegates of the Evidence-Based Health Care Teachers and Developers conference (Dawes et al., 2005). In an attempt to provide consistency to the evidence-based practice movement, the Sicily Statement addressed the demand for a clearer definition of what evidence-based practice really was, as well as provided recommendations for the future. In recognising the growing evidence-to-practice gap, the statement highlighted the importance of effective teaching of EBP to undergraduate students as a way of preparing practitioners for the future.

Since publication of the Sicily statement there has been further research into EBP curricula across different health disciplines, however the focus has been primarily on teaching strategies rather than student learning factors (Young et al, 2014). Limited guidance exists regarding what actually influences undergraduates to learn EBP in order to practise competently and confidently after graduating, as mandated by professional requirements across disciplines. This is in contrast to the plethora of research over the years aimed at teaching health professionals' skills to change their practice to be based on evidence (Ibbotson, Grimshaw & Grant, 1999; Green, 1999; Horsley et al., 2011; Taylor et al., 2000; Taylor, Reeves, Ewings & Taylor, 2004; Young et al., 2014). An umbrella review of systematic reviews (Young et al., 2014) highlighted the need for clinically integrated teaching interventions across levels of health professionals. The synthesis investigated effectiveness of EBP teaching interventions for health professionals and some student populations at different stages of learning. From the 16 included systematic reviews, only one was specifically aimed at undergraduate students, from the field of medicine. The remaining included reviews comprised health professional roles or a mix of post-graduate student and health professional populations. Results of the umbrella review identified EBP educational activities that used clinically integrated and/or multimodal strategies had an effect on improving undergraduate students' EBP knowledge, skills and attitudes (Young et al., 2014). However, the authors reported on a notable absence of long-term effects of behaviour change, because primary outcomes of change in knowledge, skills & attitude provided no indication of how these domains affect EBP implementation.

For undergraduate students, education on fundamentals of EBP as well as implementing evidence in clinical practice is complex. Education programs are required to assist students to learn EBP knowledge, skills and behaviours that traverse both academic and clinical environments. It has been suggested that many undergraduate students struggle with this complexity especially if the education is delivered out of clinical context (Melnyk, 2013; Nickerson and Thurkettle, 2013). EBP implementation is perceived by some students as too difficult to achieve due to negative EBP educational experiences, focusing heavily on research principles with exclusion of relevant clinical integration (Bozzolan et al., 2014; Melnyk, 2013). Such perceptions are concerning in light of reported low rates of evidence implementation.

A commentary by Greenhalgh et al., (2014) suggests collaborative research across disciplines is urgently needed, with consideration of cognitive psychology, educational theory and a more patient centred focus to evidence-based behaviours and clinical decision making. The authors suggest the lack of such an approach to-date has been detrimental to sustainability of evidence-based practices. There is a call for a return to the basic premise of EBP that involves moving beyond appraisal skills and focusing on integrating evidence use in a pragmatic and humanistic manner to improve patient outcomes (Greenhalgh et al., 2014). Teaching students to embrace such concepts can be challenging, especially if they are not observing such behaviours in practice during the course of their learning.

Godin, Bélanger-Gravel, Eccles & Grimshaw (2008) contend the significant gap of implementing evidence in practice may be related to individual factors, thus deeper understanding is required of cognitive processes supporting particular choice of behaviour (Godin et al., 2008). Michie et al. (2005) support this view, suggesting that implementation of EBP can be enhanced by interventions based in psychological theory. Incorporating social cognitive theory into strategies to effect behaviour change is suggested for improving health professionals' choice of behaviour. It is feasible that such an approach may also assist undergraduate students to develop and sustain EBP behaviours in clinical practice, but limited research has explored this.

According to Bandura (1977, 1997), if a person is to feel confident when applying a new skill, they not only need knowledge, but also motivation and a strong perceived self-efficacy. Despite being a recommended domain for EBP development (Tilson et al., 2011), further exploration on the extent to which self-efficacy is developed or evaluated within EBP undergraduate health curricula, is limited. Bandura's framework has been applied to educational contexts, with reports of a direct relationship between self-efficacy (including perceived self-efficacy) and academic outcomes (Bandura, 1977; 1993; 1997; Pajares, 1996; Pajares & Miller, 1994: Phan, 2011; Wood & Locke, 1987; Zimmerman, Bandura, & Martinez-Pons, 1992). In the field of health professional education, some single discipline studies report application of Bandura's framework to undergraduate health students' development of EBP self-efficacy, but not in a generic EBP educational context (Artino et al., 2012; Bennett, Hoffmann, & Arkins, 2011; Forsman et al., 2012; Lee & Schuman, 1987; Spek, et al., 2013a; Spek et al., 2013b). There is also limited research on how or if self-efficacy or other factors influence students' intention to use EBP, which will be discussed further in the thesis.

1.2 Concepts and definitions relative to this research

The following section will introduce and outline some of the main concepts that will be referred to in this thesis and are important for the basis of the proposed research study. For this study, an undergraduate student is defined as one who is undertaking their first academic degree for a specific subject.

1.2.1 The role of evidence for evidence-based practice

Translating knowledge derived from evidence into clinical practice has been a significant problem for healthcare personnel (Pearson, Jordan & Munn, 2012). Knowledge translation has been defined as a method for closing the gap between knowledge and practice (Kitson & Harvey, 2016; Straus, Tetroe, & Graham, 2009). Considerable expenditure supports scientific research discoveries of new medications and treatments in the laboratory, yet a growing divide exists between laboratory work and clinically relevant research (Butler, 2008; Woolf, 2008). Confusion about translational research exists due to the presence of distinct gaps, which are frequently merged into one process; this is visually represented in Figure 1.

Figure 1-1. Gaps in translational research (source: Pearson et al., 2012)

Gap one, more commonly known as T1, relates to research of basic sciences, completed in laboratories and tested in clinical trials. The ‘bench-to-bedside’ terminology refers to the discovery process of translational research. Growing concerns over patient safety and implementing treatments based on low evidence have resulted in greater focus on Gap 2, the timely translation of evidence into real clinical practice (Butler, 2008; Naik & Petersen, 2009; Woolf, 2008). Straus et al., (2009) suggest the knowledge translation process is cyclical, comprising stages of inquiry, synthesis of knowledge implementation and evaluation.

Evidence-based practice requires translating research into clinical practice through synthesis, implementation and evaluation processes. When best research evidence is combined with clinical expertise and patient preferences, the three main elements of evidence-based practice are being addressed (Haynes, Devereaux, & Guyatt, 2002; Sackett et al., 1996). The most commonly accepted meaning of EBP has evolved from Sackett and colleagues’ definition of evidence-based medicine (EBM), which is,

> "…the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. (Sackett et al., 1996, p. 71)."

This conceptual definiton of evidence for practice has been the basis for many EBP education programs.

1.2.2 Evidence for clinical practice

Defining evidence for clinical practice is difficult due to complexity and potential ambiguity of the concept. While information such as patient medical records, physical assessment and observation records as well as diagnostic findings are used to support clinical decisions and can be used as legal evidence in a court of law (Kohn, Corrigan, & Donaldson, 2000), Sackett and colleagues (1996) advocate for clinical practice being based on "best available external clinical evidence from systematic research (p.71)". Determining best research evidence for clinical practice is achieved through minimising bias (Pearson, Wiechula, Court & Lockwood, 2007; Rycroft-Malone et al., 2007). Subsequently, research evidence for clinical practice and decision-making is exposed to scrutiny to determine quality and validity (Rycroft-Malone et al., 2004). A well-conducted systematic review of randomised controlled trials can offer the highest quality evidence on effectiveness of a health intervention however, different clinical problems require different types of research evidence (Sackett et al., 1996; Straus & McAlister, 2000). Rycroft-Malone et al. (2004), propose that evidence for practice is based on knowledge and experiences gathered during the patient/practitioner relationship. Such knowledge can range from stories told by patients to multiple sources of professional knowledge including but not limited to research evidence and clinical expertise (Rycroft-Malone et al., 2004).

1.2.3 The EBP process

The five-step EBP process adopted by most healthcare personnel includes:

- asking a structured and focused clinical question;
- collecting the best evidence available;
- critically appraising the evidence to ensure validity, relevance and applicability;
- applying or integrating the results into practice, and
- evaluating outcomes (Sackett & Rosenberg, 1995).

Although originally introduced in the field of medicine, reference to the five steps of the evidence-based practice process can be seen in many other health fields including nursing, allied health, social work and paramedicine (Burns & Foley, 2005; Ciliska, 2005; Dawes et al., 2005; Fineout-Overholt & Johnston, 2005; Ilic, 2009; Johnston & Fineout-Overholt, 2005; Peterson, Phillips, Bacon, & Machunda, 2011; Bellamy et al., 2013). By nature of acceptance that EBP consists of a sequence of steps, it is understood that EBP is a *process* (Dawes et al., 2005). A common misconception of EBP is that if someone is practicing individual steps of EBP then they are implementing the EBP process; however, undertaking critical appraisal of one research study is not the same as implementing evidence-based practice, it is part of the process. This misconception has been one hindrance to teaching the EBP process (Dawes et al., 2005; Fineout-Overholt, Melnyk, & Schultz, 2005) and will be discussed further in Chapter 2. Since being first reported, there have been developments and modifications to the process, which will also be discussed further in Chapter 2.

As highlighted by Young et al., (2014), the basis for most teaching and learning programs for EBP is the steps of the process (Sackett et al., 1996). For students to learn about EBP implementation, the conceptual model of EBP must also be considered, which incorporates patient preferences, clinical expertise and available resources, to improve patient outcomes. This presents a complex teaching phenomenon, incorporating process and conceptual components in both clinical and academic environments. The complexity has presented challenges to successful adoption of EBP in undergraduate programs across disciplines (Ciliska, 2005; Finotto, Carpanoni, Turroni, Camellini & Mecugni, 2013; Moch, Cronje & Branson, 2010; Meats, Heneghan, Crilly & Glasziou, 2009) which will be discussed further in the thesis. The following sections will outline the significance, scope and aims of the research study.

1.3 Significance and scope of the proposed research

Since introduction of the need for evidence to support clinical practice, undergraduate students have mostly been excluded from the discourse, which presents a paradox, in light of registration and licensing requirements. Previous research into teaching EBP has focused primarily on teaching critical appraisal skills and knowledge to health professionals and/or postgraduate students (Coomarasamy & Khan, 2004; Taylor et al., 2000; Young, et al., 2014), with emphasis on individual steps of EBP rather than the whole process. Undergraduate students are proposed to have different needs and motivations for learning EBP (Coomarasamy & Khan, 2004, Ilic, 2009), and may have difficulty foreseeing application of EBP to their future practice (Forsman et al., 2012). Despite this, the recommendation for EBP to be a life-long learning process (Dawes et al., 2005; Glasziou, Burls, & Gilbert, 2008; Ilic, 2009; Ilic, 2009; Young, Rohwer, Volmink, & Clarke, 2014) suggests the earlier this education begins, the better.

Despite the call for health professionals to base their practice on evidence, reports of low evidence implementation rates exist (Grimshaw et al., 2012; Kitson & Harvey, 2016; Straus et al., 2013), highlighting a gap between clinician's knowing about EBP and implementing actual behaviours. Translating evidence into clinical practice is known to be a complex issue with reports that 20-30% of patients still receiving unsafe and/or inappropriate care (Grimshaw et al., 2012; Grol & Grimshaw, 2003), and a large proportion of patients receiving care not based on available evidence (Godin et al., 2008; Grimshaw et al., 2012; Kitson & Harvey, 2016; Straus et al., 2013). Graham et al., (2006) extend this problem further, reporting that the confusion with concepts and terminology of knowledge translation has resulted in some interventions from single research studies being instigated too quickly without stringent analysis, also resulting in detrimental patient outcomes (Graham et al., 2006). Such examples of low EBP implementation, although primarily in the field of medicine, raise questions regarding how students can effectively learn behaviors that are not routinely being practised.

Recommendations from regulatory bodies for EBP to be included in registered health professionals' clinical care and decision making, has increased interest and subsequent pressure to modify undergraduate curricula to meet such requirements (Fineout-Overholt et al., 2005; Fineout-Overholt, Stillwell, & Kent, 2008; Kohn et al., 2000; Forsman et al., 2012). Despite this, identifying an acceptable level of EBP competency to meet such criteria remains unclear. Teaching students a process-based approach that includes and overlaps with a conceptual model is challenging from both pedagogical and practice perspectives.

As mentioned above, for undergraduate health students to meet such criteria, learning EBP knowledge and skills alone may not be sufficient (Ciliska, 2005; Florin et al., 2012; McEvoy et al., 2010; Spek et al., 2013a). Research is limited regarding factors that influence undergraduate students across health disciplines to adopt EBP practices. Some primary research exists on undergraduate students' intention to use EBP after they graduate (Brown et al., 2010; Forsman et al., 2012; Iovu, 2016; Kim, Brown, Fields & Stichler, 2009). Complexity involved in measuring intended clinical behaviours makes evaluation of effective teaching strategies difficult (Tilson et al., 2011), as few strategies are followed into the clinical environment (Forsman et al., 2012). Learning about EBP crosses academic and clinical contexts, which can present a barrier to student EBP development if there is a disjoint between taught content and actual clinical practice (Young et al., 2015).

Incorporating social cognitive theory (SCT) into education programs has been suggested across disciplines for improving health professionals' EBP implementation, through providing better understanding of individual EBP behavioural choices (Greenhalgh et al., 2014; Godin et al., 2009; Michie et al.,2005). Self-efficacy, as part of SCT can motivate individuals to overcome challenges (Bandura, 1977) and for undergraduate students, incorporating self-efficacy development into curriculum could assist translation of EBP knowledge into actual practice (Forsman et al., 2012), however this has not been previously investigated in depth, nor in a generic context.

1.4 Aim of this research

The aim of this research was to contribute to the research gap on undergraduates' learning of evidence-based practice. Despite mandates for a level of EBP competence upon graduation, there is currently limited evidence on factors that influence undergraduate students' intention to adopt EBP in their practice after they graduate (Forsman et al., 2012). Identification of such factors will assist curriculum developers to ensure students are being educated to meet health professional EBP registration criteria, with the subsequent goal of improving patient outcomes.

More specifically, this research investigated the application of Bandura's self-efficacy construct (Bandura, 1977, 1997) from social cognitive theory to two multivariate prediction models with the aim of identifying factors influential to undergraduate students' use of EBP after graduation. Factors that influenced undergraduate students' current EBP use during their learning course were also examined.

There were two stages to this research. Firstly, a systematic review was undertaken to synthesise research evidence on factors influencing undergraduate health students' intention to use EBP in their practice following graduation. A synthesis of such studies has not been previously undertaken and results of the systematic review were integral to the second stage of the research study. Factors identified from the research synthesis were examined for inclusion in the modelling processes in Stage 2.

The second stage of the research aimed to incorporate factors influential to undergraduates' development of EBP, as identified from the systematic review, the theory and literature, into two multivariate prediction models. The first model was developed to identify factors influencing undergraduate health students' intention to use EBP after graduation. The second model investigated factors influencing undergraduate students' current use of EBP during the course of their learning. The prediction models were grounded in Bandura's self-efficacy construct (1977, 1997), and were developed using structured equation modelling (SEM) processes of path analysis to identify relationships and influences among and between the independent and dependant variables and the extent to which these variances occurred (path coefficients). The aim of the analysis was to determine the extent to which the models captured influential factors and identified the magnitude of factors affecting undergraduate student's self-efficacy for EBP. After the models were developed and model fit determined, a second episode of data collection was collected from a separate cohort of undergraduate health students, to validate the prediction models. Specific research questions and hypotheses for the research study are outlined below.

1.5 Research Questions

The three research questions investigated by this research study were:

1. What factors predict undergraduate health students' intention to practice EBP following graduation?

2. What factors predict undergraduate health student's use of EBP during the course of their learning?

3. Does Bandura's self-efficacy construct provide an appropriate framework for predicting undergraduate health student's current use of EBP and/or their intention to use EBP after graduation?

1.6 Hypotheses

The hypotheses presented below in the null form, relate to the broad objectives of the study and will be revisited at the conclusion of the thesis.

1. $H_{0:}$ There is no association between variables included in the theory-based model and undergraduate students' intention to practice EBP after graduation.

2. $H_{0:}$ There is no association between variables included in the theory-based model and undergraduate health students' current EBP use.

1.7 Summary

There is a lack of theoretically based evidence on factors specifically influencing undergraduates EBP uptake, across healthcare disciplines, to support their registration requirements following graduation. Exploring such influences may uncover strategies to assist transition and integration of EBP from education to practice. Undergraduate students come from diverse backgrounds and experiences; some student's may have prior experience and some EBP knowledge while other students may have had no EBP experience, nor prior academic learning experience (Taylor & Hamdy, 2013). This variation adds to the complexity of determining undergraduate educational needs. EBP can present as a new and complex concept and expectations exist for students to develop their knowledge of EBP as well as attitudes, beliefs and capability regarding EBP, to prepare for implementing such practices following graduation.

This exploratory study will contribute to the gap in knowledge regarding factors that affect students' learning about the EBP process. In the context of documented low evidence implementation rates and the need for guidance for EBP educators to prepare students to meet their licensing and/or registration requirements, this study will provide guidance on areas that contribute to sustainable EBP development.

1.8 Thesis outline

This thesis comprises seven chapters. Chapter 1 has introduced the 2-stage research study and briefly highlighted the challenges and limitations of current undergraduate EBP education. It has outlined the background, significance and scope of the research as well as the research questions, aims and hypotheses for the study.

Chapter 2 presents a review of the literature on evidence-based practice and undergraduate students. It will discuss the historical development of EBP education and present strategies that have been adopted previously for EBP education. Chapter 2 will also present current research on factors influencing undergraduate student EBP education and highlight gaps in the research as well as areas that impact EBP learning. It will discuss the theoretical model underpinning this research, namely

Bandura's self-efficacy theory (Bandura, 1997), and how this theory is proposed to support the current research study.

Chapter 3 will present the systematic review conducted as Stage 1 of this research. The systematic review was undertaken to identify and synthesise any previous modelling studies on undergraduate students' intention to use EBP following graduation. The chapter will outline methods and conduct of the systematic review as well as present findings of included studies in narrative and tabular form. Recommendations for teaching and learning as well as further research extending from the systematic review will be presented. Variables identified in the systematic review as being predictive of student intention to use EBP will be considered for inclusion in the second stage of the research study.

Chapter 4 will discuss methods for developing the prediction models for Stage 2 of this research. The procedures for two episodes of data collection will be presented along with variables for developing the prediction model, the methods for variable selection and tools for data collection as well as methods for data analysis.

Chapter 5 presents results of the two episodes of data collection and development and testing procedures for two multivariate prediction models. The first model presents factors influencing undergraduate health students' intention to use EBP in practice while the second prediction model investigated influential factors for undergraduate health student's current EBP use. Sample characteristics are presented, along with bivariate correlations and the process of model development from the hypothesised model to the trimmed and tested model. Model indices for goodness-of-fit are reported for the model fit and validation processes. Results from the regression analyses as part of the structural equation modelling, will also be presented in this chapter.

Chapter 6 analyses and discusses the results presented in Chapter 5. The implications of findings from Stage 2 of the research, namely the prediction model, will be presented, in the context of undergraduate education. The discussion will include an analysis of the applicability of the underpinning theory for this research. Limitations of the research study are presented in this chapter as well as implications for undergraduate health professional education and implications for future research.

Chapter 7 concludes the thesis. A summary of each stage of the research will be presented and the hypotheses outlined in Chapter 1 will be revisited to identify if they have been supported or refuted by the research.

1.9 Chapter summary

Chapter 1 has outlined the proposed research that aims to investigate factors influencing undergraduate health students' intention to use EBP. The background to the study has been presented along with the significance and scope of the research. Research questions and hypotheses have been presented as well as an outline of the thesis document. The following chapter will present a review of the literature regarding the topic.

Chapter 2: Literature Review

2.1 Introduction

This chapter provides a comprehensive analysis of the literature surrounding undergraduate students and their place within the field of EBP, with a particular goal of addressing literature relating to three research questions outlined in Chapter 1. It will briefly discuss the historical development of EBP, then outline in detail the development of EBP education and the way in which such programs have or have not addressed the needs of undergraduate students. Available literature on factors that influence undergraduate students' learning, use and intention to adopt EBP will be presented. This will include reference to reference to pedagogical approaches, recommendations and challenges as identified in the literature. The chapter will culminate in a discussion on Bandura's self-efficacy construct and present how the construct supports the proposed research. To support the call for a broader, collaborative approach to EBP and interprofessional education (Dawes et al., 2005; Tilson et al., 2011; Greenhalgh et al., 2014; WHO, 2010) the review of the literature is compiled from an evidence-based health care perspective, incorporating appropriate literature from multiple disciplines, not from a single discipline perspective. It is acknowledged that evidence-based medicine was the founding term for evidence-based practice and evidence-based healthcare; hence, there is some overlap in use of these terms. This is reflective of the state of the literature.

2.2 Search strategy

A comprehensive review of the literature of papers from 1990 to 2015 was undertaken with searches conducted on the following databases: CINAHL, PubMed (including Medline), ERIC, Scopus, Proquest Health, The Cochrane library, The Campbell Collaboration, The Joanna Briggs Database and specific journal searches included The International Journal of Evidence Based Healthcare, Worldviews on Evidence-based Nursing, Evidence Based Healthcare (Science Direct), and Evidence Based Healthcare and Public Health. The search started from 1990 as this was when the topic of EBP, originally known as evidence-based medicine (EBM), became prominent in the literature.

2.3 Introduction to evidence-based practice

The philosophical origins supporting evidence for practice are reported to be as far back as the mid-19th century (Sackett et al., 1995). Nurse researchers contend that Florence Nightingale was a pioneer of evidence-based principles in Nursing, suggesting she implemented the process when caring for patients during and after the Crimean War (McDonald, 2001). In the 1970's Professor Archie Cochrane, promoted ways to synthesise multiple research findings for practice (Cochrane, 1972), for clinicians to have greater confidence in choosing effective treatments for their patients. His ideas became the foundation of the modern evidence-based medicine movement, despite criticism in relation to his impassioned promotion of the randomised control trial as the best quantitative measure of effectiveness in healthcare.

Researchers at McMaster University in Toronto built upon Professor Cochrane's work, with development of systematic review methodology and other methods to utilise and share research for physicians to use in practice (Belsey, 2009). An early commentary by Dr Gordon Guyatt (1991) introduced medical practitioners to a journal club as a way of obtaining current, appraised medical information quickly and efficiently. Practitioners were encouraged to use information management and research appraisal skills to aid decision-making, rather than rely on expert opinion or out-dated textbooks. In his editorial on treating iron deficiency anaemia, Guyatt discussed how a physician might treat a patient using "*the way of the future*" (Guyatt, 1991, pp. A-16), by applying "*skills of literature retrieval, critical appraisal and information synthesis*" (Guyatt, 1991, pp. A-16). While these skills have been accepted as integral to EBP process, it is important to note they are not representative of the entire EBP process.

Critique of the EBM movement suggested that there was and continues to be, heavier weighting on the research component of the definition of evidence, due to epidemiological emphasis and preference for the randomised trial for effectiveness, as recommended by Cochrane (Cochrane, 1972; Hoffmann, Bennett & Del Mar, 2013; Mykhalovskiy & Weir, 2004; Rycroft-Malone, 2006). Misconceptions regarding the meaning of evidence for practice, such the randomized control trial always being the best evidence or that the model ignored clinical expertise, led to clarification of a broader definition (Pearson et al., 2007; Rycroft-Malone et al., 2004; Sackett et al., 1996). Despite criticisms and challenges (Bastian, et al. 2010; DiCenso, Guyatt & Ciliska, 2005; Mykhalovskiy & Weir, 2004; Greenhalgh et al., 2014; Grol & Grimshaw, 2003; Grol & Wensing, 2004; Sackett et al., 1996), fundamental concepts of using evidence to support decisions affecting clinical care, have since been accepted in varied healthcare contexts and disciplines to improve patient safety and subsequent outcomes.

2.4 EBP for patient safety

Incorporating evidence as an integral part of clinical practice is motivated by the need for improved patient safety. In 2000 the Institute of Medicine published a report on the quality of American health care (Kohn et al., 2000), recommending standards for quality patient care be extended to all health professions and consequently be reflected in each professions' education and preparation for professional practice. Such recommendations have been adopted in other countries also (Boström, Rudman, Ehrenberg, Gustavsson & Wallin, 2013; DiCenso et al., 2014; Nursing and Midwifery Board of Australia, 2006). Despite these recommendations, reports exist of up to 55% of American adult patients not receiving recommended clinical care (McGlynn et al., 2003; Grimshaw et al., 2012; Straus et al., 2009). In Australia, only 57% of patients were reported to receive recommended, evidence-based care from primary care episodes recorded over a 12-month period (Runciman et al., 2012). Such examples are not limited to the field of medicine with Melnyk (2016), highlighting continued use of outdated nursing practices such as regularly waking physiologically stable patients every four hours overnight to check vital signs. The NHS Atlas of Healthcare Variation (2011), has identified many serious aberrations in the UK between recommended and current care. The authors suggest the five major challenges to global health care systems include:

- Unwarranted variation in quality and outcome
- Harm to patients
- Waste, and failure to maximize value
- Health inequalities and inequities
- Failure to prevent disease (NHS Right Care, 2011; p. 18)

The literature highlights the growing impetus and ongoing need for not only changing health professional behaviour, but to also train new professionals on how to incorporate evidence in their practice to improve patient outcomes.

2.5 EBP conceptual and process models

Sackett & Rosenberg (1996) originally defined evidence-based medicine as:

> …The conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research (Sackett et al., 1996, p. 71).

Sackett and colleagues (1996) suggest best available evidence is therefore an integration of three factors; clinical expertise, results of high-level systematic, clinical research and patient preference. The authors emphasise the factors overlap and may have different weightings in clinical practice (Sackett et al., 1996; Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000). Other disciplines have since adopted and expanded the definition. Some authors suggest expanding the conceptual evidence implementation model to consider available resources (Hoffmann et al., 2013), and organisational context or environment (Bellamy et al., 2013; Kitson, Harvey & McCormack, 1998; Rycroft-Malone et al, 2002; 2008). Each of the factors to some degree influences how clinicians make decisions regarding care for their patients (see Figure 2-1).

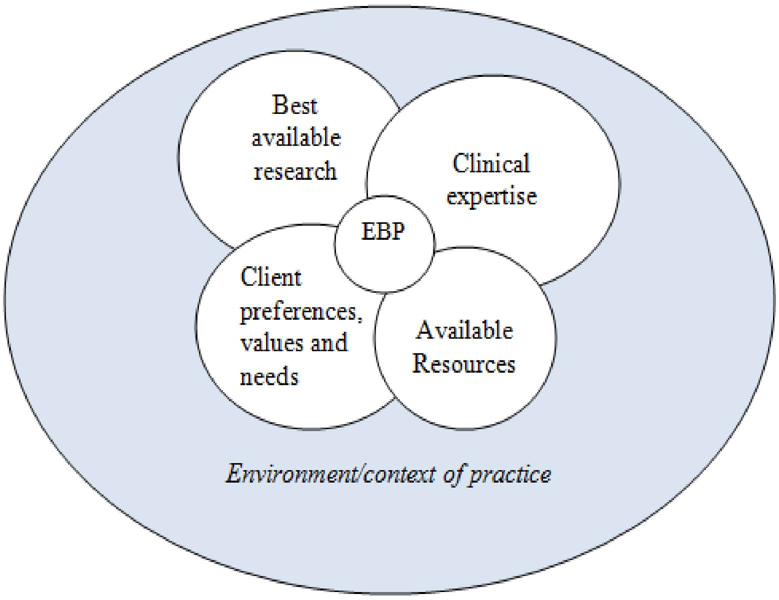

Figure 2-1. Interconnected concepts of EBP (Bellamy, 2013; Hoffman et al., 2013; Kitson et al., 1998; Sackett et al., 2000)

Many evidence implementation models have since been developed to support and direct health professionals toward improving practice through translating EBP knowledge to direct patient care (Khalil, 2016). Such frameworks provide health practitioners with support for changing practice within their clinical contexts. Through development and refinement of the Promoting Action on Research Implementation in Health Services (PARiHS) Framework, Kitson and colleagues

(1998; 2008; 2016) acknowledge that evidence implementation is not a linear process. The authors promote facilitation as a major component of their framework suggesting the role, attributes and style of the facilitator are influential toward enabling and adopting evidence-based practices within an organisation (Harvey et al., 2002; Kitson et al., 1998; Rycroft-Malone et al., 2002; Kitson et al., 2008; Kitson & Harvey, 2016). It is unknown how or if students fit within implementation models as they are commonly left out of discussions regarding EBP implementation, however clinical facilitation may be crucial also, through enabling students to achieve behaviours

As well as providing a conceptual model of EBM, Sackett and colleagues proposed a process for the actual practice of EBM (Sackett & Rosenberg 1995; Sackett et al, 1996) upon which most EBP educational programs are now based upon. The five basic steps of the EBP process, generally accepted within most health professions (Burns & Foley, 2005; Ciliska, 2005; Dawes et al., 2005; Fineout-Overholt & Johnston, 2005; Finotto et al., 2013; Ilic, 2009; Johnston & Fineout-Overholt, 2005; Levin & Feldman, 2012; McEvoy et al., 2010; Peterson et al., 2011, Young et al., 2014), comprise:

- asking a structured clinical question;
- searching for and retrieving the best evidence available;
- critically appraising the evidence to ensure validity, relevance and applicability to the clinical or research problem;
- applying or integrating the results into practice, and
- evaluating outcomes

Critics of EBP process suggests the process is authoritative and idealistic as the nature of working with patients, and the inability to clearly define what is 'best' evidence, presents a paradox whereby clinical care decisions are grounded in something that is often not adequately defined nor clearly delineated (Nevo & Slonim-Nevo, 2011). However, as Greenhalgh et al., (2014) implore, EBP should always have "the care of individual patients as its top priority (p. 3 of 7)."

The first three sections of this review have provided a brief context of the history and development of EBP for patient care. An outline of the process and conceptual model of EBP has been presented. The following section will discuss development of EBP education programs and identify significant moments in development of EBP education. The focus of health professional EBP education will be presented first as this will lead to a discussion on applicability of such programs to meet undergraduate EBP requirements.

2.6 Development of EBP education programs

The steps of the EBP process (Sackett et al., 1996) have become the basis for many EBP education programs. Historically, EBP education programs focused on the first three steps of the process, specifically question formulation, literature retrieval and appraisal (Hoffman, Montori & Del Mar, 2014; Thomas, Saroyan & Dauphinee 2010; Phillips et al., 2014; Young et al., 2014). Early evaluations of such programs found mixed results of effectiveness (Fu, Hodges, Regehr, Goldbloom, & Garfinkel, 1999; Haynes, Johnston, McKibbon, Walker, & Willan, 1993). A systematic review published in 2000 on the effectiveness of critical appraisal teaching strategies (Taylor et al., 2000), included 10 studies with participants being medical students or medical residents. The number of teaching strategies ranged from 2 sessions in one week to 16 sessions over a year, with heterogeneity of interventions a major limitation to the review. Measured outcomes were grouped into four categories - medical literature reading behaviour, ability to appraise research articles, epidemiology and/or statistical knowledge and attitudes toward medical literature. The authors reported use of low quality tools for measuring outcomes and wide variation in results (Taylor et al., 2000). A 2001 Cochrane Review, updated in 2011, found that teaching health professionals critical appraisal skills resulted in some improvements in EBP knowledge but the authors recommended more methodologically sound research, suggesting incorporation of adult learning theory would be beneficial (Horsley et al., 2011; Parkes, Hyde, Deeks & Milne, 2001).

In 2005, 86 international delegates at the Evidence-Based Health Care Teachers and Developers conference (Dawes et al., 2005) disseminated the Sicily Statement on evidence-based practice after a consensus process. The Statement articulated necessity for practitioners to delineate the evidence-based process and recommended EBP educational training commences in the early years of health professional courses. Recommendations emerged for grounding curriculum in the five steps of the EBP process so that all health professionals were able to recognise, understand, implement and evaluate their clinical practice. To achieve this, clinically integrated teaching practices were supported so that,

> …students not only learn the principles and skills, but learn how to incorporate these skills with their own life-long learning and patient care. (Dawes et al., 2005, pp. 4-5 of 7)

A further recommendation from the Sicily Statement was acceptance of language that encompassed acceptance across disciplines; suggesting that the term Evidence-Based Medicine, be changed to ‘evidence-based practice’ (Dawes et al., 2005). However, since publication of the Sicily Statement, the change in terminology has not been embraced and continued use of terminology such as evidence-based medicine, evidence-based nursing, evidence-based physiotherapy, evidence-based psychology and evidence-based social work implies a segregated, discipline specific approach to learning about the EBP process and incorporating evidence into practice (McEvoy et al., 2010; Satterfield et al., 2009).

EBP education is complex and effectively incorporating evidence into practice requires some consideration of research curricula (Coomarasamy & Khan, 2004). Ciliska (2005) suggests educators should carefully consider if they are teaching for research or for EBP, as the two concepts will require different strategies. Traditional content for EBP programs can range from instruction on epidemiology and biostatistics to inclusion of content regarding evidence hierarchies, study design and levels of evidence in order to quantify research quality (Green, 1999; Young et al., 2014; Hoffman et al., 2013). The evidence pyramid is commonly found in EBP programs, as it was developed to identify quality of research studies, with the assertion that the higher up the pyramid, the better the quality of evidence (Hoffmann et al., 2013). Critique on the hierarchy pyramid identifies lack of consideration for the type of clinical question being asked and a heavy focus on study design (Coleman et al, 2005; Fineout-Overholt et al., 2005). Determining appropriate evidence is ascertained by the actual research question being asked (Evans, 2003; Polit & Beck, 2014), which may not always be a question of effectiveness. Consequently, use of a hierarchy has received criticism (Nevo & Slonim-Nevo, 2011). Updates to evidence hierarchies include the development of the 6S hierarchy for pre-appraised evidence (Di Censo et al., 2009) as a quick tool for clinicians to determine quality and applicability of synthesised research information to assist making decisions (see Figure 2). Tools such as this have been promoted for inclusion in EBP programs to encourage student engagement with the EBP process within their clinical environments (Bozzolan et al., 2014; Melnyk, 2013).

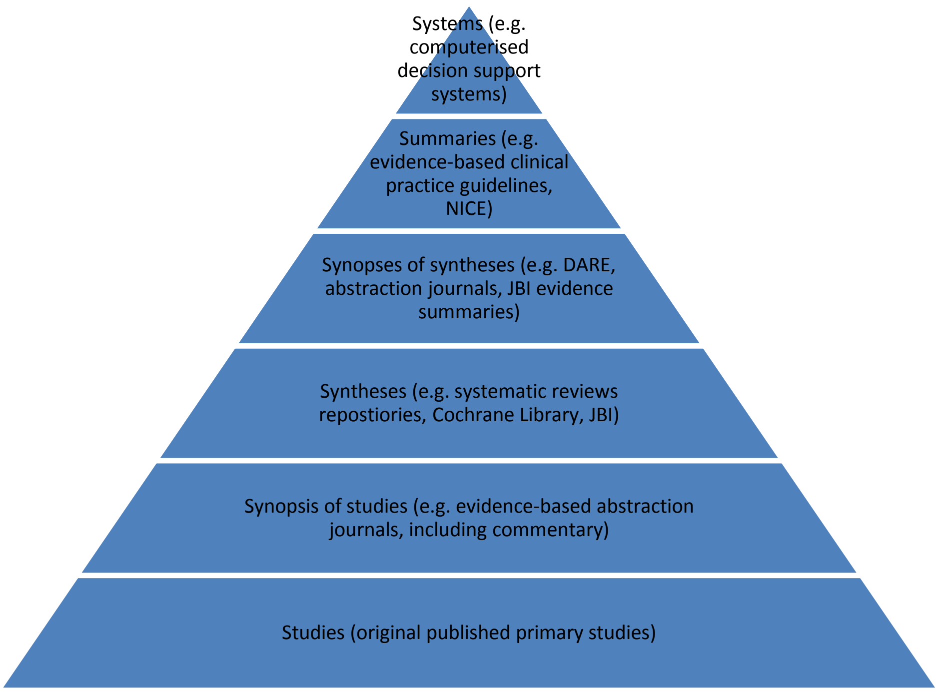

Figure 4: 6 S Model of pre-appraised evidence resources. Adapted from: DiCenso, A., Bayley, L., & Haynes, R. B. (2009). Accessing pre-appraised evidence: fine-tuning the 5S model into a 6S model. *Evidence based nursing*, *12*(4), 99-101.

A predominance of content regarding research methods and statistical testing rather than integration of research evidence to solve patient related, clinical problems is highlighted as a major barrier to student engagement with EBP (Bozzolan et al., 2014; Fineout-Overholt & Johnston, 2005; Meats et al., 2009; Melnyk, 2013). Students report frustration with epidemiology and statistical content (Meats et al., 2009) and report difficulty identifying relevance of research content to clinical practice (Ilic, 2009). Young et al, (2015) highlighted student committment as a significant issue in delivering EBP education, particularly if students are unable to see the context in which evidence-based health care (EBHC) is delivered. Their qualitative study of 24 international evidence-based health care (EBHC) teachers and program coordinators, highlighted the importance of clinicians as EBP role models for students so application of evidence can be seen in practice (Young et al., 2015). Revision of curricula for undergraduates is highlighted in the literature, with recommendations for greater focus on clinical EBP integration and incorporation of social cognitive theory to understand barriers and facilitators to behaviour change (Forsman et al., 2012; Greenhalgh et al., 2014; Meats et al., 2009).

An update to the Sicily Statement, published in 2011 (Tilson et al., 2011), provided further discussion on the complex dimensions of EBP learning and teaching, suggesting effective EBP training should be "matched to the needs and characteristics of the learner audience" (Tilson et al., 2011, p. 2 of 10). Tilson et al. (2011) recommended that EBP education programs encompass multiple categories including, but not limited to, knowledge, skills, belief and self-efficacy in EBP to assist those engaged in learning EBP principles to meet required competencies, taking into account different types of learners i.e. health professionals or students.

The categories (see Table 2-1) were based on the Kirkpatrick Hierarchy of Levels of Evaluation and work by Freeth and colleagues (Freeth, Hammick, Reeves, Koppel, & Barr, 2005; Hammick, Freeth, Koppel, Reeves & Barr, 2007; Tilson et al., 2011) and were agreed upon after a consensus meeting of EBP teachers from across 12 countries (Tilson et al., 2011).

Table 2-1
Educational assessment categories

Educational Assessment Category	**Example**
Learner's reaction to EBP educational strategy	Does the learner feel benefit following the EBP educational experience?
EBP attitudes	Does the learner value EBP as important to their clinical practice?
EBP self-efficacy	Does the learner feel they have confidence and capability to undertake EBP process?
EBP knowledge	Does the learner know sufficient EBP principles, e.g. can they formulate a research question to address the problem being investigated?
EBP skills	Can the learner find information effectively?
EBP behaviours	Does the learner recognise gaps in knowledge relating to clinical care and pursue answers
Patient Benefit from EBP	Does the learner recognise improvement in patient outcomes from implementing EBP?

Source: Tilson J, Kaplan SL, Harris JL, Hutchinson A, Ilic D, Niederman R, et al. Sicily statement on classification and development of evidence-based practice learning assessment tools. BMC Medical Education. 2011; 11(1):78. p. 2 of 10

The Kirkpatrick model, originally published in 1959 was considered the most influential training evaluation program adopted by organisations to evaluate effectiveness of training programs (Bates, 2004). Four levels of evaluative criteria are specified in the original model, namely, reaction to the training program being delivered, learning criteria (e.g. knowledge, attitudes, skill), employee behaviour change and end results (Kirkpatrick, 1996). The pragmatic nature of the model is proposed to be the reason for such widespread acceptance (Kirkpatrick, 1996; Bates, 2004). Early critique suggested the model reflects a taxonomy or simplistic classification, rather than theory (Holton III, 1996) and discord between learner evaluation criteria (i.e. reaction to the experience) and organisational results following from the training program, confounds overall results of effectiveness. There is an assumption that a positive reaction to the training will lead to effective behaviour change (Bates, 2004, Holton 111, 1996). The association between these outcomes was investigated further in a meta-analysis of effectiveness and relationships between training programs in organisations (Arthur Jr et al., 2003) with results supporting the idea that measuring learning outcomes against organisational benefits does not indicate a direct causal relationship (Arthur Jr et al., 2003; Bates, 2004; Holton III, 1996). Organisational outcomes following from individual learning experiences do reflect individuals' capability for the specific task being learnt. It is feasible that an individual may successfully learn a new task but may not implement it successfully due to negative environmental influences (Arthur Jr et al., 2003).

Regardless of early criticism, the Kirkpatrick model still presents as an influential learning framework, especially within medical education (Buckley et al., 2009; Reeves, Perrier, Goldman, Freeth & Zwarenstein, 2013; Steinert et al., 2012; Tilson et al., 2011, Young et al., 2014). Yardley & Dornan (2012) suggest the model is most appropriate if applying it to evaluate simple educational strategies, which may imply it is not the most appropriate framework for EBP educational strategies for undergraduate students who are undertaking learning experiences in a variety of environments and diverse organisations. Additionally, evidence is lacking of sustainability of behaviour change following implementation of interventions based on the framework, particularly from a student perspective.

A more recent evidence synthesis on effective EBP teaching programs has been reported by Young et al. (2014). The umbrella review of systematic reviews on EBP education from 1993 to 2013 comprised 15 published and one unpublished systematic reviews. Each of the included reviews evaluated single and/or multi-faceted educational interventions aimed at improving various EBP outcomes including, but not limited to, knowledge, critical appraisal skills, attitudes and behaviours, with one of the included systematic reviews considering EBP self-efficacy as an outcome (Coomarasamy & Khan, 2004). Populations for the systematic reviews included undergraduate and postgraduate students as well as health professionals from disciplines of medicine, nursing and allied health. Reported small sample sizes and heterogeneity of study aims, outcomes and populations were methodological limitations of the systematic reviews included in the umbrella review and consequently meta-analysis was not possible. The authors recommended a multifaceted approach, for teaching EBP to students, utilising strategies such as journal clubs, small group sessions, computer labs, lectures and/or workshop formats was the most effective approach for effecting positive changes. As the review synthesised systematic reviews of populations of mixed levels with various experiences of EBP, results should be interpreted cautiously for different cohorts. The review identified a continued focus on measuring short-term gains of EBP knowledge and skills such as critical appraisal, with a lesser focus on EBP attitudes and beliefs and very few studies measuring other learning outcomes. Outcomes were reported to align with three levels of the Kirkpatrick model. The authors highlighted the difficulty in measuring the fourth of Kirkpatrick's levels, namely change in patient outcome following learning about the EBP process (Young et al., 2014).

Teaching students how to evaluate patient outcomes is frequently absent from EBP educational programs. A systematic review by Phillips et al. (2014) analysed 61 EBP teaching interventions for health professionals and health professional students at postgraduate and undergraduate levels, to determine which components were reported most frequently. Results of the review identified only 38% of the included studies reported their interventions included a component on how to apply EBP in practice and only 7% included content on how to evaluate if EBP implementation was effective or otherwise (Phillips et al., 2014). It could be argued that without teaching steps of implementation and evaluation the complete EBP process is not being considered. The systematic review forms part of an ongoing process for developing guidelines for the reporting of educational interventions, which is currently lacking in the literature.

This section of the literature review has provided an overview of traditional content of EBP programs and introduced some challenges present in making programs applicable and relevant to undergraduate students. The literature identifies a predominance of interventions aimed at health professional behaviour measuring outcomes of EBP knowledge, attitudes and skills and to a lesser degree, postgraduate students (Flores-Mateo & Argimon, 2007; Ilic & Maloney, 2014; Phillips et al., 2014; Young et al., 2015). Even fewer studies are aimed at undergraduate students. This is despite recommendations from the updated Sicily Statement for EBP content to be matched to audience level (Tilson et al., 2011) and mandates from professional licensing bodies for undergraduates to have EBP capability upon graduation (Dawes et al., 2005; Fineout-Overholt et al., 2004; Forsman, et al., 2012). Challenges in designing and implementing EBP programs for undergraduates relate to relevance of content and clinical integration of delivered content (Bozzolan et al., 2014; Ilic, 2009; Melnyk, 2013). The following section will discuss the available research and literature specifically on factors that influencing undergraduate students learning about EBP. Studies reporting student intention to incorporate EBP into practice after graduation will also be discussed.

2.7 Factors influencing undergraduate EBP education

Hatala and Guyatt (2002), suggested at the time of their publication, the evidence base for teaching EBP specifically to undergraduates was limited. The authors noted the irony of this situation suggesting that the development of evidence-based guidelines for teaching EBP at that time would be based on the "lowest level of evidence" (Hatala & Guyatt, 2002, p. 1110). Following from this an early systematic review on teaching medical postgraduate students identified that integrating EBM into clinical teaching resulted in positive changes to attitudes, skills and behaviour in postgraduate medical students compared to teaching EBM in a traditional, classroom-based, didactic method (Coomarasamy & Khan, 2004).

Coomarasay & Khan reported that learning processes for undergraduate students differ to postgraduate students due to different motivations for learning (Coomarasamy & Khan, 2004). Basing their argument on adult learning theory, the authors suggest postgraduate students are more self-motivated than undergraduates are and their desire to learn EBP is based on clinical relevance. Undergraduates however, may be new to the clinical environment and are often driven by more extrinsic factors such as assessments (Ilic, 2009). Cheng et al. (2012) support this, suggesting the focus of passing exams is a priority for undergraduate students, which can be a challenge for the timing of delivering EBP programs. Timing educational interventions to when students are ready and able to understand the link between clinical and academic areas, requires further consideration.

Following from their systematic review, Khan and Coomarasamy (2006) proposed a hierarchy of teaching interventions, whereby interactive, clincally integrated teaching interventions are proposed to be the most effective way for students to learn EBP, followed by either interactive classroom teaching or didactic but clinically integrated methods, with the lowest level being classroom, stand-alone or didactice methods (Khan & Coomarasamy, 2006). A more recent study by Young et al, (2015) argues that although such a hierarchy is beneficial it still does not demonstrate the best way to implement clinically integrated activities. Their qualitative study interviewing 24 international evidence-based health care (EBHC) teachers and program coordinators highlighted the importance of clinicians as EBP role models for students and the challenges of implementing a 'truly' clinically integrated EBP program (Young et al., 2015). Although this study focused on teacher rather than student perspectives one of the main themes arising was in regard to challenges of student committment to engage in EBHC suggested undergraduate students were unable to see the context in which EBHC is delivered. This qualitative study followed from an earlier umbrella review of systematic reviews (Young et al., 2014) mentioned previously on the effectiveness of teaching EBP strategies. Although the umbrella review comprised mixed populations of students and health pofessionals the comprehensive research presents a complex phenomenon highlighting many challenges.

Taylor and Hamdy (2013) suggest medical students come into their education with a variety of experiences; this observation applies to all health care students. Some students come to university straight from school while others may be mature age students with practical experience in similar fields. Some students have had life experiences that relate to their chosen course of study, while others may have started one university course and changed to a different one (Taylor and Hamdy, 2013). Regardless of their background, each undergraduate student is proposed to be an adult learner and as such, a range of learning styles should be considered by educators (Straus et al., 2013; Taylor & Hamdy, 2013; Aglen, 2015) as learning needs will differ. Outcomes for EBP knowledge often demonstrate greater effect in undergraduate students compared to postgraduates, which has been attributed to differences between the groups at baseline (Wong et al., 2013). Specifically, undergraduate students were proposed to have a lower level of EBP knowledge and less clinical exposure compared to postgraduate students prior to the EBP intervention (Coomarasamy & Khan, 2004; McEvoy et al., 2010; Wong et al., 2013).

Opinions on the most effective pedagogical or theoretical basis for undergraduate EBP education are mixed and to-date no systematic review on the most effective framework is available. A literature review on pedagogical strategies for undergraduate EBP highlighted numerous influences toward student learning of EBP suggesting there were two goals of EBP education for students. Firstly, to teach a level of information literacy skills and secondly, teaching for knowledge translation and implementation (Aglen, 2015). In contrast to recommendations for use of the Kirkpatrick model as a base for EBP learning (Tilson et al., 2011), Aglen (2015), suggests undergraduate EBP education requires a combination of critical thinking and reflection skills intertwined with a level of professional practice competence. Thus, the best-fitting pedagogical framework for delivering such education is still to be determined. Time for reflection and time to build critical thinking skills is supported by other authors (Gloudemans, 2013; Profetto-McGrath, 2005), to allow students to successfully navigate situations of ambiguity and uncertainty, while building their capacity for professional decision-making. Problem-based EBP learning interventions have been suggested as one avenue for EBP education (Fineout-Overholt et al., 2008; Norman & Schmidt, 2009), although in studies of undergraduate students, mixed results of effectiveness have been found (Ilic & Maloney, 2014; Johnston et al., 2009). Norman & Schmidt (2000) suggest inherent issues with educational study designs confounds attempts to measure true effectiveness of educational interventions. The authors suggest investigating theory-based approaches as a way of enabling deeper understanding of influences toward such learning methods (Norman & Schmidt, 2000). The conflicting evidence outlined above suggests educators are still unsure of how best to translate EBP knowledge to practice for students.

Studies on EBP in undergraduate populations to-date, highlight predominance of primary research measuring effectiveness of teaching interventions (Aronoff et al., 2010; Barghouti et al., 2013; Bozzolan et al., 2014; Cheng et al., 2012; Ilic & Maloney, 2014; Johnston et al., 2009; Kim et al., 2009; Kritikos, Carter, Moles & Krass, 2013; Lai & Teng, 2011; Liabsuetrakul et al., 2013; Ma et al., 2014; Sánchez-Mendiola, Kieffer-Escobar, Marín-Beltrán, Downing, & Schwartz, 2012; Zhang, Zeng, Chen & Li, 2012). Frequently reported outcomes included changes in domains of EBP knowledge, skills and/or attitudes. A protocol for a systematic review to synthesise such studies has been developed and published; both on the Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports and on the Prospero database (Refer Appendix A). Preliminary synthesis identifies heterogeneous interventions and populations, delivered at different times within the undergraduate curriculum, with mixed results of effectiveness. Duration of interventions also varies significantly from 2-day workshops (Alahdab et al., 2012) to semester-long (12-15 week) interventions (Ruzafa-Martinez et al., 2016; Sanchez-Mendiola et al., 2012). Few studies measure EBP competence (Ruzafa-Martinez et al., 2016; Ilic et al., 2015) or EBP self-efficacy in undergraduates (Oh et al., 2010), which limits confidence in knowing if students really do feel prepared to use EBP after graduation.

The majority of primary studies on undergraduate EBP education report short-term interventions with measurements of effectiveness taken immediately after delivery of the program (Alahdab et al., 2012; Barghouti et al.,2013; Cheng et al., 2012; Johnston et al., 2009; Lai & Teng, 2011; Ma et al., 2014; Sánchez-Mendiola et al., 2012; Zhang et al., 2012). A mixed methods study of physiotherapy undergraduates (Bozzolan et al., 2014) is one of few studies found to have investigated influences on the effect of an EBP education intervention across the duration of their three-year undergraduate program. Mixed results were identified in the domains of EBP knowledge and skills, across different year levels and the students reported perceived barriers to effective EBP in their clinical environments. Lack of time to look for articles, difficulty in linking what was learnt in class to actual practice and difficulty with learning statistics and research methodology concepts were some of the barriers reported by students in the qualitative interviews (n=30). The facilitators in the clinical environments had major influence over student perception of the relevance and importance of EBP; facilitators lacking in EBP skills themselves were not supportive of students' needs (Bozzolan et al., 2014). Lack of time and lack of support during clinical placements were also identified as barriers in a cross-sectional study of Norwegian undergraduate physiotherapy students (Olsen et al., 2014). Melnyk (2013) suggests teaching students within an interprofessional context, using rapid critical appraisal skills will assist in improving student's perception of EBP being more achievable. The use of pre-appraised evidence (DiCenso et al., 2009) is also suggested by Bozzolan et al., (2014) as a method for overcoming time constraints and making EBP appear more achievable for undergraduates.

The content of EBP educational interventions for undergraduates is mostly based on the steps of the EBP process (Sackett et al., 1995). Variations to the five steps exist with some authors supporting a seven step approach whereby 'step 0' promotes initiating a culture of inquiry (Melnyk, Fineout-Overholt, Stillwell, &

Williamson, 2010; Bloom, Olinzock, Radjenovic, & Trice, 2013). Melnyk and colleagues (2010) suggest that without questioning clinical decisions, the subsequent step of asking a clear and focused research question, will not transpire. Step '0' has also been proposed as recognising ones' own knowledge deficits, as finding gaps in knowledge creates further inquiry (Meats et al., 2013; Johnston & Fineout-Overholt, 2005). Step 7 focuses on disseminating results with the aim of reducing repetition in research and increasing consistency in practice (Melnyk et al., 2010). Bloom et al, (2013) report grounding their EBP nursing curricula on the seven-step process, proposing only the first four steps are aligned with undergraduate capability, with the latter steps being achievable by postgraduate students. This is in contrast to Bozzolan et al., (2014) who specified steps of implementation and evaluation in their teaching strategy for undergraduate physiotherapy students. Some researchers report use of a '5 A's approach' for EBP (Bellamy et al., 2013; Young et al., 2014). This presents in the literature with variation of the actual words of the acronym such as ask, access, appraise, apply, audit (Young et al., 2014), or ask, acquire, audit, assess, analyse, adjust and/or audit (Cheng et al., 2012; Ilic, Nordin, Glasziou, Tilson, & Villanueva, 2015). Although wording and principles of each step are similar, such ambiguity in terminology can present challenges regarding consistency for EBP education, especially with undergraduate students who are trying to grasp fundamental concepts.

Undergraduate health professional students undertake their learning in both clinical and academic environments. Thus, their EBP learning experience can be influenced by both contexts. Gloudemans (2013) suggests the student-learning environment also comprises peers and teachers and both will have influence toward student success in developing critical thinking skills and self-efficacy for EBP. Environmental support was highlighted as an integral factor towards student belief in their individual capability for EBP, in a large cross-sectional study of 26 Swedish universities by Florin et al., (2012). Students' perceived support for using research evidence was higher in the university environment than in clinical settings, with statistically significant differences for this finding found between different universities. Students reported higher correlations in EBP capability for some aspects of the EBP process such as finding literature and appraising studies. Lower correlations were identified for implementing and evaluating evidence use, where students relied on partnership with more experienced nurses. The study was part of a longitudinal research project providing extensive research on a large cohort of students and professional nurses, following them from pre-graduation into their professional life. Outcomes measured included intention to use evidence and actual use of evidence in practice (Bostrom et al., 2013; Forsman et al., 2012; Rudman, Omne-Pontén, Wallin, & Gustavsson, 2000; Rudman, Omne-Pontén, Wallin, & Gustavsson, 2010; Wallin, Bostrom, & Gustavsson, 2012; Wallin & Ehrenberg, 2004). Mixed results on student intention to use EBP and actual use of EBP suggest more research is required regarding students' decisions regarding EBP.

Llasus, Angosta, and Clark (2014) investigated relationships between undergraduate nurse's self-reported EBP knowledge, readiness to practice and implementation, finding that the population of nurses in the study (n=174) were overly confident of their ability to competently practice EBP upon graduation, but their fundamental EBP skills and commitment to implementation of EBP were lacking. Forsman et al, (2012) followed nursing students into their first year of practice and measured their actual research use in practice compared to their intended use, measured a year prior, reported a similar finding. Results from their study found student's intention to use research in practice as measured in the pre-graduation survey, was significantly correlated with their observed EBP behaviours in their first year of professional practice. However, despite the significant correlation between intention and behaviour, the nurse's beliefs of their own capability to implement EBP were found to influence their intention. The authors' reported that although nurses initially intended to incorporate research into their practice, lack of belief in the value of using the best available research evidence as well as lack of support in both academic and clinical environments, resulted in nurses not actually undertaking the behaviour (Forsman et al., 2012). The authors recommended greater role modelling and mastery opportunities would be beneficial for improving EBP capability beliefs (self-efficacy). It is noted that the author interchanged the concepts of evidence-based practice and use of research in practice, which can be argued as being two distinctly different constructs (Yoder, 2014). Both Llasus et al., (2014) and Forsman et al., (2012) recommend focusing education programs on building EBP capability to improve student engagement with EBP following graduation. This suggests future interventions require strategies that support development and use of EBP in practice.

Few studies report on use of EBP by new graduates or on undergraduates' actual use of EBP during their learning. Some authors suggest that newly graduated students are theoretically in a pivotal position for implementing evidence, as they are eager to apply learnt skills to practice (Cronje & Moch, 2010); in other disciplines, results are mixed. For example Simpson, Bendall, Patterson & Middleton, (2012) reported Australian paramedics (n = 892) with less than five years experience placed a significantly higher value on EBP influencing their care than senior paramedics. A cross-disciplinary survey by Weng et al., (2013) also found new health professionals with less than 5 years experience (n = 2111) had higher reports of EBP implementation than those with 5-10 years experience. In contrast to this, Forsman et al., (2009) reported low to very low levels of actual EPB use by nurses at one to three years' post-graduation. A further study by the same authors reported nursing students' intention to use EBP prior to graduation was mixed (Forsman et al., 2012); some students never intended to use EBP in practice while 34% of the sample intended to use EBP more frequently. Choices regarding intention were determined to relate to individual decisions and/or characteristics (Forsman et al., 2012). Such variation in intention to use EBP requires further investigation.

This section of the literature review has summarised the state of research on undergraduates' EBP education, which although limited in number and quality, is growing rapidly. Mixed reports exist of student attitudes toward and belief in the value of EBP (Bozzolan et al., 2014; Ruzafa-Martinez et al., 2016; Sanchez-Mendiola et al., 2012), yet few studies have explored factors that ultimately influence use of EBP in practice after they graduate (Forsman et al., 2012). Studies measuring short-term changes in EBP knowledge and skills do not provide evidence of student capability to adopt EBP behaviours (Ciliska, 2005; McEvoy et al., 2010). Mixed results on EBP capability and factors that affect student confidence for EBP behaviours have been found suggesting more research is required in this area. Studies grounded in psychological or social cognitive theory are proposed to improve understanding of clinician's behaviour (Godin et al., 2008), yet few studies are found to mention theory-based interventions for undergraduate students (Artino et al., 2012; Forsman et al., 2012; Lee & Schmaman, 1987; Kim et al., 2009; Spek et al., 2013a). The call for EBP education to be grounded in social cognitive theory as a way of understanding individual behaviour choices (Godin et al., 2008; Greenhalgh et al., 2014; Michie et al., 2005) will be explored further in the next section of the literature review.

2.8 Psychological theory for changing behaviour

Psychological and/or social cognitive theories suggest that behaviour is determined through a combination of cognitive and affective factors with some influence from environmental, cultural and personality determinants. Many psychological theories have been developed in order to explain human behaviour (Ajzen, 1991; Bandura, 1977; Schwarzer, 1994; Sutton, 2001). A recent scoping review by Davis, Campbell, Hildon, Hobbs & Michie (2015), investigated behaviour change theories relating to public health interventions. Although 82 different theories were reported on, four of these were identified as accounting for the majority (63%) of reported studies. The four main theories were the Transtheoretical Model of Change (TTM), the Theory of Planned Behaviour (TPB), Information-Motivation-Behavioural-skills Model (IMB) and Social Cognitive Theory (SCT) (Davis et al., 2015). Further evidence supports positive outcomes from implementing health interventions based on social cognitive theory (SCT) (Angus et al., 2013; Hardeman et al., 2002).

More specifically regarding EBP, research has been conducted on the value of incorporating SCT into health professionals' behaviour to promote adoption of EBP, both in the clinical setting (Eccles et al., 2007; Eccles et al., 2006; Grimshaw et al., 2011; Munro, Lewin, Swart, & Volmink, 2007; Wilkinson, Hinchliffe, Hough, & Chang, 2012) and from an educational perspective (Tilson et al., 2011). Evidence exists supporting the predictive power of such theories, with a systematic review by Eccles and colleagues (2006) suggesting for health professionals, intention can be an acceptable measure for subsequent behaviour when supported by an appropriate theoretical framework (Eccles et al., 2006). No such evidence exists for supporting theory-based behaviour change in undergraduate students.

A systematic review by Godin et al. (2008) reported 76 studies on the intention of varying groups of health professionals to use research in practice, based on social cognitive theories. The review was undertaken in order to address the growing gap between health professionals' knowledge of evidence-based practice and lack of clinical implementation of such practices. The incorporation of social cognitive theory was under the premise that understanding behaviour is a key factor in implementation of research to practice. Methodological limitations of small sample sizes and incongruence between behaviours measured and the measurement tools used, were noted. The authors identified a complex interaction between behaviour intention and factors such as (but not exclusive to) role and identity, health professional characteristics, social influences, capability and consequence beliefs. The authors concluded that strategies grounded in SCT might provide greater benefit to changing behaviours (Godin et al., 2008; Michie et al., 2005). For health professionals, the Theory of Planned Behaviour (TPB) (Ajzen, 1991, 2011) was most frequently used to support behaviour change, yet as studies included were analysing health professional behaviours, not student behaviours, it could be argued that the results should not be extrapolated to undergraduate student populations as there may be different influencing factors between the two populations.

2.9 Bandura's Social Cognitive theory

Social Cognitive Theory (SCT) is founded on the idea that people are agents for their own behaviour (Bandura, 1977; 1997). Agency is seen as intentional, in that people will deliberately act a certain way to achieve a desired outcome. However, Bandura suggests intention is only one component influencing human agency, as forethought, the ability to self-reflect and self-regulate all affect a person's behaviour choice (Bandura, 2004; Parajes & Usher, 2008). Individuals therefore reflect on their behaviour and make changes according to their own desired outcomes, based on previous experience. Behaviours are not only influenced by individual cognitive process such as memory retention and response, but also from environmental factors including observing the behaviour of others (Bandura, 1977, 1997, 2004). The three factors of behaviour, environment and personal factors are represented in Figure 2-2 below, and are seen as interacting and reciprocal elements in human agency.

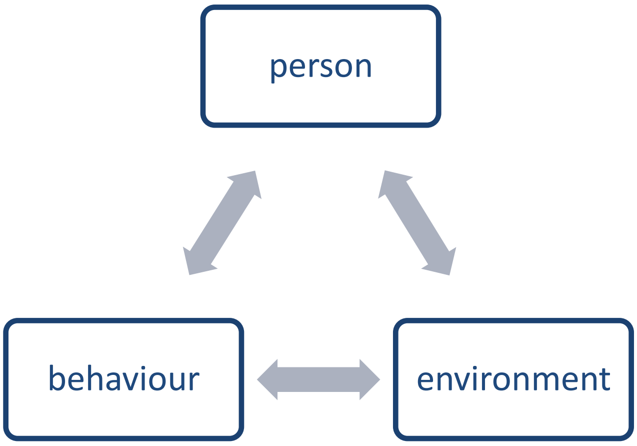

Figure 2-2. Representation of Bandura's three determinants in human agency (adapted from Bandura, 1977; 2002)

Personal factors relate to beliefs, attitudes and other affective processes influencing the intended behaviour or effect (Bandura, 1977; 2002). Prior experiences and/or false beliefs in one's ability can influence such factors hence; there is a cognitive component to the choice of behaviour (Bandura, 2002; 2012). Cognitive processes also contribute to personal factors, and may be overriding in some situations; such cognitive processes are emphasised as a major influence toward building self-efficacy (Bandura, 1978, 2002; Pajares & Usher, 2008). Behavioural factors refer to the individual's response to the situation. Observing other people's reactions and/or incorporating one's personal beliefs are behavioural influences (Bandura, 1977; 2002). Environmental factors that influence behaviour apply to imposed, selected or created environments (Bandura, 1997). Imposed environments may be physical or those created from societal influences. People may feel they are unable to control imposed environmental factors but they are able to control their attitude and perception of such environments. How a person engages within their environment will determine their selected environment, for example, a student struggling with understanding a particular concept may avoid attending classes (Bandura, 1989). Created environment is determined by ones' ability to develop social systems that will support their ongoing development (Bandura, 1997). This social influence is particularly relevant within the student-learning context.

The factors represented in Figure 2-2, reflect the concept of reciprocal determinism (Bandura 1978; 1997; 2002; Pajares & Usher, 2008) and do not represent strictly linear relationships. That is, at different times and for different situations, each factor may have a different influence (Bandura, 2002). For example, in situations where there are imposed environmental restrictions, such as in an exam situation, behavioural and personal factors can exert more influence on the individuals' response to the imposed restrictions. This concept is unique to Bandura's theory as it allows focus on all aspects of determining behaviour rather than a predominance of any one particular component (Pajares & Usher, 2008).

Bandura's social learning theory (as a precursor to social cognitive theory) suggests the learning environment is a flexible entity and has a reciprocal relationship with behavior and subsequent learning (Bandura, 1971, 2002). More specifically, an individual's behaviour can influence their environment while the environment can in turn influence the individual's behaviour (Bandura, 1971). Learning in such environments, can be achieved by observation or by direct experience (Bandura. 1971; 2002) and as such, role models are a crucial influence toward learning behaviours, exerting either a positive or a negative influence. Role models can, "serve as instructors, motivators, inhibitors, disinhibitors, social facilitators and emotion arousers (Bandura, 1978, p. 23)." As such, modelling within the learning environment exerts a powerful influence, particularly for building knowledge and capability for a particular skill (Bandura, 1978). This factor may be a crucial component for students attempting to learn new clinical behaviours.

Gloudemans, Schalk, Reynaert & Braeken (2013), identified the importance of a learning environment that supports self-efficacy as a way to improve student nurses' critical thinking. The study tested and validated a structural equation model based on Bandura's four sources of self-efficacy, on 230 Dutch nursing students. Results confirmed five sources of self-efficacy rather than four as the students received peer and expert based vicarious experiences (role models), which influenced their self-efficacy for critical thinking (Gloudemans et al., 2013; Gloudemans, 2013). Critical thinking is an essential component of learning about EBP (Aglen, 2015) therefore it is feasible the five-factor model is also applicable to EBP self-efficacy however more research is required to test the model. Peer learning and critical thinking have been supported in a systematic review as two crucial factors influencing university students' academic achievement in self-regulated and online learning environments (Broadbent & Poon 2015). Their role within EBP curricula is yet to be established.

2.10 Self-efficacy theory

Bandura defines self-efficacy as an individuals' judgement on their perception of their capability for organising and carrying out effort toward a goal or task (Bandura, 1994, 1977, 1997, Zimmerman, 2000). As a key construct within SCT, self-efficacy has direct effect on performance and consequently is a motivator for individual behaviour. More specifically, a positive outcome will increase a person's belief that they are capable of a task, thereby allowing them to feel confident to perform the task effectively, again. As mentioned above, cognitive processes are part of individual behaviour determinants and can be motivation for particular behaviours. When people will think about the behaviour they wish to undertake, they will also think about the anticipated outcome. This outcome expectancy forms a distinct part of Bandura's self-efficacy theory. Bandura suggests that distinguishing between efficacy expectation (that is, an individual's belief that they can perform a certain task) and outcome expectancy is essential, as often the outcome expectancy will drive the motivation to perform the task. Conversely, if a person does believe performing a task will have a positive outcome they may not perform the behaviour even if they believe they can. The differences between efficacy expectations and outcome expectancy are seen in Figure 2-3.

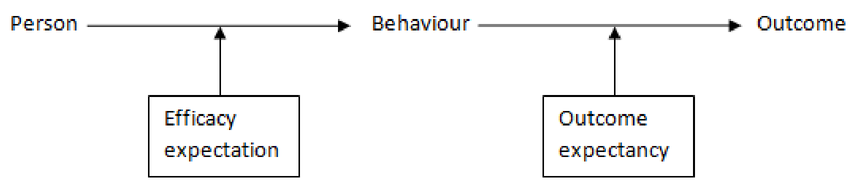

Figure 2-3. Difference between efficacy expectation and outcome expectancy (from Bandura, 1977)

According to Bandura, dimensions of self-efficacy expectations can vary in different contexts. For example, the magnitude of individual efficacy expectations can vary according to level of difficulty of the task (Bandura, 1977; Zimmerman, 2000). Generality of efficacy expectations can differ according to transferability of expectations across tasks (Bandura, 1997; Zimmerman, 2000) and strength of efficacy expectations can influence perseverance for a task as those with stronger efficacy expectations will persist despite having negative experiences (Bandura, 1977). It is important to specify that a person’s efficacy expectations relate to self-judgement on their performance or capability and are not a critique on how they are feeling (Zimmerman, 2000). Some authors interchange the term ‘capability beliefs’ when referring to efficacy expectations, particularly in studies of evidence-based practice (Florin et al., 2012; Forsman et al., 2012; Wallin et al., 2012).

Bandura suggests that self-efficacy is specific to an individual task rather than a general state of being which is in contrast to Schwarzer’s theory of generalized self-efficacy (Jerusalem & Schwarzer, 2014; Schwarzer, Bäßler, Kwiatek, Schröder, & Zhang, 1997). Specificity in self-efficacy is an important factor when analysing student behaviour as students with high self-efficacy for some aspects of learning may not automatically have the same level of confidence or self-efficacy in other areas. Generalized self-efficacy suggests that an individual’s overall feelings of optimism and self-belief will motivate them to become successful at achieving a behaviour or task. According to Schwarzer (1994) generalized self-efficacy is a broader construct, is applicable across cultures and domains (Schwarzer et al., 1997), and represents a personal trait within the individual. Schwarzer’s research on generalized self-efficacy proposes that people with a high degree of generalized self-efficacy will be able to persist with a variety of tasks regardless of how challenging the conditions surrounding them are (Schwarzer, 1994; Schwarzer et al., 1997).

Conversely, Bandura's self-efficacy construct proposes that people may differ in their efficacy state according to the task undertaken, and even within specific aspects of the task. Even if an individual has a successful experience in performing a behaviour, she/he may still have a low level of self-efficacy in that task due to previous experiences or her/his perception of the conditions surrounding them (Bandura, 2006, 2012). In other words, even though an individual may be able to complete a task they may not have a high level of confidence in their ability to do so. Bandura explains that self-efficacy can be increased through four information sources namely, performance accomplishments, vicarious experience, verbal persuasion and emotional arousal (Bandura, 1977, 1997). It is important to note however, that self-efficacy information sources are influenced by the individuals' own perception of their ability as well as social and contextual factors (Bandura, 1997), hence the importance of supportive learning environments. Educational psychology supports Bandura's social cognitive theory as a framework for different academic levels and in various contexts of learning (Bandura & Locke, 2003; Pajares, 1996; van Dinther, Dochy & Segers, 2011; Zimmerman et al., 1992; Zimmerman, 2000). Despite this, few studies have used the theory as a guide for developing EBP education programs.

2.11 Self-efficacy and student learning

Self-efficacy, is recommended specifically to be part of EBP learning criteria (Tilson et al., 2011), as despite having knowledge and skills, clinicians require self-confidence in order to implement EBP into practice (Chang & Crowe, 2011; McSherry, Artley, & Holloran, 2006; Michie et al., 2005; Salbach, Jaglal, & Williams, 2013). Development and testing of tools to measure self-efficacy have been reported in nursing and midwifery (Chang & Crowe, 2011; Swenson-Britt & Berndt, 2013; Tucker, Olson, & Frusti, 2009), with one tool also being used in a generic capacity to measure allied health EBP confidence and knowledge (Chang & Crowe, 2011); however, very few studies report measuring the construct in undergraduate students. Spek and colleagues (2012; 2013a; 2013b), analysed EBP knowledge, skills, task value and self-efficacy, in Dutch speech therapy students across different year levels. Grounding their studies in Bandura's self-efficacy construct, findings identified that although students' knowledge and skills improved over the duration of the course, students held low self-efficacy beliefs for implementing EBP into their clinical practice. The authors suggest low confidence could influence students' lack of EBP use after graduation and therefore curriculum should address how self-efficacy levels can be improved (Spek et al., 2013a).

For undergraduate students to feel confident to apply newly learnt EBP behaviours, they not only need knowledge and skills, but motivation and a strong perceived self-efficacy that they can base their practice on evidence (Bandura, 1997; Spek et al., 2013a). That is, they must have confidence in their ability to achieve the behaviours taught to them. Bandura's construct of self-efficacy is an appropriate theoretical framework for this study as it has strong support in research on student learning (Bandura & Locke, 2003; Pajares, 1996; van Dinther et al., 2011; Zimmerman et al., 1992). From an academic learning perspective self-efficacy is a major factor affecting student learning, motivation and achievement, as students with high self-efficacy will set harder goals and will persist with difficult tasks in order to achieve while students with low self-efficacy will give up earlier (Phan, 2011; van Dinther et al., 2011; Zimmerman et al., 1992). Self-efficacy can be a behaviour predictor and is said to affect one's career choice, as students will choose career options that meet their perceived capabilities (Bandura, 2012). Educational programs based on SCT taking into account the self-efficacy construct, have potential to be more successful than programs that do not use such a framework however, according to van Dinther et al. (2011) further research is required to confirm this.

Studies in educational research identify a strong link between academic self-efficacy and student success. A seminal study by Zimmerman, Bandura and Martinez-Pons in 1992, examined the role of self-efficacy beliefs and goal setting among high school students. The study used questionnaires to explore relationships between student perceptions of self-efficacy to achieve academically, their perceived efficacy for self-regulated learning as well as their goals and parental goals for their academic success. The study results were compared to students' final grades as well as prior grades for the subject. A path analysis model was calculated demonstrating statistically significant associations between students' perceived self-efficacy for achievement and student goals, accounting for 31% of the variance of the student's final achievement. There was a non-significant relationship between previous grades and final grades and although parental goal setting, along with student self-efficacy and personal goals, had a predictive effect on final grades, the study identified that perceived self-efficacy to achieve goals (outcome expectancy), set by the students themselves was the main predictor for final academic success (Zimmerman et al., 1992). Self-efficacy of students in subsequent education research supports the findings of this study and reinforces the link between self-efficacy, competence and performance across various levels of education and in different contexts (Pajares, 1996; Usher & Pajares, 2006; van Dinther et al., 2011). Although there are many studies that concur on the importance and relevance of considering self-efficacy when designing education programs or teaching strategies, agreement on the best way to measure self-efficacy in the context of higher education is still evolving (Usher & Pajares, 2009). It is important to emphasise that this information relates to academic self-efficacy and as Bandura states, self-efficacy is specific to a certain task, therefore it should not be presumed that students with high academic self-efficacy would automatically have high self-efficacy in EBP. Higher education students can be strategic learners (Coffield, Moseley, Hall & Ecclestone 2004), a concept originally highlighted by Entwistle (1982) and Entwistle & Ramsden (1982; 2015), whereby students merge surface and deeper learning strategies to achieve their optimal pass mark. If passing an assessment is the students' main motivation, then applying what is learnt for practice may be difficult to sustain, which is where self-efficacy theory may be most pertinent.

2.12 Summary of literature review

EBP education is multifaceted and there is agreement that it is a lifelong learning process (Callister, Matsumura, Lookinland, Mangum, & Loucks, 2005; Ilic, 2009; Young et al., 2014, Dawes et al., 2005), yet the role of undergraduates in the process is yet to be confidently established. Despite the requirements for undergraduate students to be capable EBP users after they graduate, and the call for EBP education to be specific for the intended audience (Tilson et al., 2011), the literature identifies a significant gap in evidence specifically directed at undergraduate EBP education and preparing them to confidently use evidence in their practice. There is research suggesting individual learning factors are important for EBP education however there is still a greater focus of literature on EBP teaching strategies. Despite a number of syntheses, results on such strategies are mixed, with predominance of short-term measurements of changes in domains of EBP skills and knowledge. Evidence of sustainability of EBP behaviour change in students is limited.

Professional registration requirements necessitate students should have sufficient EBP knowledge and skills so that they can incorporate this into their patient decision making processes. Bandura's' self-efficacy theory (Bandura, 1977, 1997) is an appropriate framework to base EBP learning behaviours upon and may benefit students in that it will assist to instil confidence that can then be carried over into clinical practice. EBP learning strategies, grounded in Bandura's self-efficacy theory, may improve student confidence to implement EBP (Boström et al., 2013; Forsman et al., 2012; Gloudemans et al., 2013; Spek et al., 2013a; Wallin et al., 2012). Further research is required to see if a self-efficacy based, generic approach to EBP, can predict student intention to use EBP after graduating.

The body of research suggesting incorporating social cognitive theory into EBP education may improve evidence implementation rates is predominantly focused on changing behaviour in health professionals (Cane et al., 2012; Eccles et al., 2007; Godin et al., 2008; Grimshaw et al., 2011; Wallin et al., 2012;). To instil positive behaviours in the first instance, factors influencing undergraduate students EBP should be investigated. The following chapter presents Stage 1 of the research, specifically, a systematic review on modelling studies aimed at predicting undergraduate health student’s intention to use research after graduation. Findings from the systematic review will guide the second stage of this research study.

Chapter 3: Systematic Review

3.1 Introduction to Chapter

The following chapter outlines methods used for Stage 1 of this research, a systematic review that was undertaken to identify the current state of research regarding predictive factors that influence undergraduate students' intention to use EBP in their practice following graduation. Specifically, this chapter firstly presents the background for the systematic review, then the protocol setting out the review methods flowed by a report of the results and discussion of the implications of the findings of the systematic review.

3.2 Background to topic under review

Internationally, licensing and/or Government authorities mandate undergraduate students across different health disciplines are required to incorporate evidence-based practice (EBP) skills and knowledge into their clinical decision-making and professional practice (Bloom et al., 2013; Ciliska, 2005, Johnson et al., 2010; Kohn et al., 2000; Meats et al., 2009; Melnyk, Fineout-Overholt, & Mays, 2008; Tilson et al., 2011). Despite these requirements, previous research relating to EBP has predominantly focused on changing behaviour to improve evidence implementation by either health professional's (Grol & Grimshaw, 2003; Horsley et al., 2011; McEvoy et al., 2010; Michie et al., 2005) or post graduate students (Coomarasamy & Khan, 2004; Flores-Mateo & Argimon, 2007), rather than instilling and developing positive EBP behaviours in the early student years. Despite recommendations for a life-long learning approach to EBP and professional practice

(Dawes et al., 2005; Glasziou, Burls, & Gilbert, 2008; Ilic, 2009, Young et al., 2014), evidence on how to instil and develop this in undergraduate students is limited.

In 2005, a group of evidence based teachers and practitioners developed and promoted the Sicily Statement as a guide for EBP educators, researchers and practitioners (Dawes et al., 2005). The statement proposed changing language and terminology to encompass a cross-disciplinary EBP culture; suggesting that the term Evidence Based Medicine be changed to 'evidence-based practice' (Dawes et al., 2005). Acceptance of a broader, collaborative approach to evidence in practice, along with revision of training curricula to include more instances of EBP integration, have been suggested as strategies to support sustainability of EBP (Greenhalgh et al., 2014; Meats et al., 2009).

An update to the Sicily statement published in 2011, outlined specific dimensions for tools that measure outcomes of EBP learning and teaching, proposing that effective EPB learning and subsequent evaluation should be "matched to the needs and characteristics of the learner audience" (Tilson et al., 2011, p. 2 of 10). Applying this to the student context implies that different approaches would then be required for educating undergraduate than for postgraduate student cohorts. Research on EBP education in postgraduate students has been reported previously (Coomarasamy & Khan, 2004, Flores-Mateo & Argimon, 2007), with systematic review results identifying integration of EBM into clinical teaching resulting in positive changes to attitudes, skills and behaviour in postgraduate medical students.

Coomarasamy & Khan, (2004) noted smaller changes in knowledge gains for postgraduate students than undergraduate students due to having had more exposure to the concepts. Guided by adult learning theory, it was suggested that differences exist between postgraduate and undergraduate students' motivation for learning with undergraduates' impetus for learning based more on assessment and external factors while postgraduates are able to apply their learning more directly to their clinical environment due to prior exposure (Coomarasamy & Khan, 2004). Although the systematic review was published over 10 years ago, researchers are still trying to clearly identifying the most effective method for undergraduates across disciplines, to learn and implement not only the knowledge and skills of EBP, but also the behaviours ascribed to the entire process.

A more recent umbrella review of systematic reviews (Young et al., 2014) investigated the effectiveness of EBP teaching interventions for health professionals and students at different stages of learning. The review included populations of undergraduate and postgraduate students as well as health professionals and highlighted the need for clinically integrated teaching interventions. Included in the review were 16 systematic reviews of which only one was specifically for undergraduate medical students and nine were a mixture of postgraduate and undergraduate students. The remaining included reviews were of health professional roles or a mix of populations. Results of the umbrella review found a variety of EBP educational activities that used clinically integrated and/or multimodal strategies had an effect on improving undergraduate students' EBP knowledge, skills and attitudes (Young et al., 2014). However, the review noted the absence of long-term effects of behaviour change also, because the primary outcomes were change in knowledge, skills & attitude there is no indication of how these domains affect student EBP implementation. As the review was focused on determining effectiveness of interventions, results cannot ascertain if undergraduate students actually feel capable to practice EBP upon graduation or intend to implement evidence in practice after they graduate.

Taylor and Hamdy (2013) suggest that medical students come into their education with a variety of experiences; this observation can extend to all health professional undergraduate students. Some undergraduates may be undertaking a second degree while others may be studying for their first degree and new to university environments. Regardless of their background and previous experience however, each undergraduate student is proposed to be an adult learner and with a range of learning styles to be considered by educators (Straus et al., 2013; Taylor & Hamdy, 2013), which adds to the complexity of the EBP learning experience. Learning about EBP crosses cognitive, psychomotor and affective domains (Nickerson & Thurkettle, 2013; Straus et al., 2013) and for health students, can traverse both academic and clinical environments. This presents a complex situation, which some students may adapt to quickly while others struggle for various reasons. Tilson et al (2011) presented recommendations for EBP education programs to address multiple categories for assessment of learner competencies. These categories include, but are not limited to, knowledge, skills, belief and self-efficacy in EBP. Bozzolan et al. (2014) suggests it is difficult to expect undergraduates to meet the minimum criteria across categories due to variation in students' clinical exposures, which may include lack of clinical EBP role models and/or educators with negative attitudes toward EBP implementation.

Measuring outcomes of undergraduate EBP implementation is currently aimed at measuring students' future or intended behaviours due to difficulty for educators to measure skills and knowledge into clinical practice after graduation (Bozzolan et al., 2014). Melnyk (2013) proposes that students see EBP implementation as too difficult to achieve because of the continued focus on teaching onerous research processes, rather than focusing on teaching EBP as an interdisciplinary, achievable activity through use of skills such as rapid appraisal. This was supported in a mixed-methods study of physiotherapy undergraduates and EBP (Bozzolan et al., 2014), where students in the focus groups (n=30) perceived EBP to be tedious and unachievable. Some students also felt a disparity between EBP assignments and actual clinical practice and reported difficulties with learning research methodologies and statistics.

The five steps of the EBP process as proposed by Sackett et al., (1995), include asking a structured clinical question; collecting the best evidence available; critically appraising the evidence to ensure validity, relevance and applicability; applying or integrating the results into practice and evaluating outcomes. Across many disciplines, there is reference to these steps as forming the basis for EBP (Bozzolan et al., 2014; Ilic, 2009; Finotto et al., 2013; Ilic, 2009; Young et al., 2014). Variations to these steps exist, such as an initial step of developing a culture of inquiry as well as a step of disseminating and sharing evidence with the aim of reducing research repetition and increasing consistency in clinical practice (Melnyk et al., 2010). By nature of acceptance that EBP comprises a sequence of steps, it is understood that EBP is a *process* (Dawes et al., 2005), consequently teaching individual steps without a context for incorporating the steps into practice may be detrimental to learning the EBP process, especially for undergraduates.

Historically, strategies for teaching EBP across health disciplines have focused on individual steps of the EBP process, particularly the first three steps of question formulation, searching and appraising literature (Horsley et al., 2011; Taylor et al., 2000). Fineout-Overholt and Johnston (2007) highlight the importance of teaching evaluation of EBP implementation, suggesting teaching evaluation with an interdisciplinary focus is essential for achieving collaborative health care goals as well as for identifying when patient care processes need to be changed. However, students need to be taught how to evaluate EBP processes in the first instance and many education programs are lacking in this step. A systematic review by Phillips et al. (2014) examined 61 EBP teaching interventions for health professionals and health professional students at various levels (i.e. postgraduate or undergraduate), to determine which components were reported most frequently. Results of the review identified only 38% of the included studies reported application of EBP in the content of their teaching intervention and only 7% included content teaching participants how to evaluate implementation in practice (Phillips et al., 2014). The systematic review formed part of an ongoing guideline development process for reporting of educational interventions.

Currently, some evidence exists that teaching EBP to students across different health disciplines in a multifaceted and integrative approach can improve EBP knowledge and skills (Ilic & Maloney, 2014; Wong et al., 2013; Young et al., 2014).

However, consideration of low evidence implementation rates (Grimshaw et al., 2012) indicates the need to examine the student EBP learning trajectory as well as the student-to-practitioner transition period to identify factors influencing actual EBP uptake. Despite recommendations from the updated Sicily Statement to include categories of attitudes and self-efficacy into EBP learning assessment tools (Tilson et al., 2011), few studies have explored the impact of all of these categories specifically on undergraduate students' actual or intended EBP use (Brown et al., 2010; Forsman et al., 2012; Iovu et al., 2015). Despite risk of self-reported intention overestimating effectiveness of an intervention due to absence of measurement of external influences (Eccles et al., 2006; Sheeran, 2002; Forsman et al., 2012), in the context of social cognitive theory, intention is recognised as having potential for predicting behaviour (Ajzen, 1991, 2011; Eccles et al., 2006; Godin et al., 2008; Wallin et al., 2012).

A call for review of research and EBP curricula with a greater focus on integrative learning is supported across health disciplines (Greenhalgh et al., 2014; Meats et al., 2009; Melnyk, 2013; Melnyk et al., 2004; Spek et al., 2013a; Young et al., 2014). Investigating relationships between factors such as EBP self-efficacy, EBP attitudes, clinical and academic support, as well as individual student factors (e.g. age, discipline) may identify areas that require greater consideration in EBP curricula with the aim of affecting EBP use following graduation. The objective of this review therefore, was to examine and synthesise studies on factors such as (but not limited to) EBP self-efficacy, attitude, skills and knowledge that influence the development of EBP behaviours and predict intention to use EBP, specifically for undergraduate health students.

3.3 Systematic review methods

This systematic review was conducted according to an *a priori* protocol (Ramis, Chang, & Nissen, 2015) (Refer Appendix B) which was published on the Prospero database (http://www.crd.york.ac.uk/PROSPERO/). Prospero is an international database where researchers can register prospective systematic review protocols. The aim of the Prospero database is to provide a permanent registry of systematic review protocols, to enhance transparency, improve reporting and enable global awareness of current systematic reviews and research evidence.

According to Moher et al. (2015), creating a protocol prior to conducting the systematic review is an essential step in the systematic review process. Systematic reviews that provide a detailed plan of the methods for conducting the review enhance transparency, accountability and rigor of the process. Inconsistencies within published systematic review reports that do not have predetermined protocol may be subject to increase reporting bias through selective reporting (Moher, Stewart, & Shekelle, 2016).

At the commencement of this review, no framework was available specifically for synthesising educational prediction studies. Critical appraisal tools for experimental and observational studies were not deemed sufficient to examine the unique characteristics of modelling studies and although the Joanna Briggs Institute were further developing tools for other epidemiological designs, none were available specific to modelling research. Consequently, the method of evidence synthesis in this review employed resources available from the Cochrane Methods Prognosis: (http://prognosismethods.cochrane.org). Heterogeneity within and across the studies limited our ability to pool data, therefore results are presented in narrative and tabular form.

3.4 Research question

The research question being asked in this review is, "What factors influence undergraduate health students' development of EBP and predict intention or future use of evidence-based practice following graduation?"

3.5 Inclusion criteria/Study characteristics for included studies

3.5.1 Types of studies

Correlational studies and EBP predictive modelling studies that examined relationships among factors were considered for inclusion. Studies that followed students from their undergraduate year into the first postgraduate year were also included.

3.5.2 Types of participants

This review considered studies of undergraduate students from all health professions, including but not limited to medicine, nursing and allied health disciplines. Studies that included a mixture of student and or health professional populations were included if data for the undergraduate population were clearly identified and able to be extracted, however studies with specific populations of post-graduate students and/or health professionals were excluded.

3.5.3 Types of exposure

As this review was focused on correlational and predictive factors, no intervention was specified. The exposure of interest related to undergraduate students' learning and their intention to use the EBP process in clinical practice. For purposes of this review, the EBP process would have been reported as being based on the steps of EBP namely: asking a structured and focused clinical question; collecting the best evidence available; critically appraising the evidence to ensure validity, relevance and applicability; applying or integrating the results into practice, and evaluating outcomes (Sackett & Rosenberg, 1995). Studies that reported variations in wording of these steps or used the '5 A's' acronym (assess, ask, access, appraise, apply) were also considered for inclusion. Studies that interchanged the terms research use and/or EBP were considered for inclusion if the primary focus was regarding use of evidence in practice.

3.5.4 Types of Predictive factors

This review considered studies evaluating predictive factors affecting the process of undergraduate development and implementation of evidence-based practice skills and behaviours. Predictive factors were grouped as personal, behavioural or cognitive factors. Specifically, personal predictive factors could include age, field of study, course year level, attitudes toward EBP, EBP beliefs and/or prior EBP experience. Behavioural predictive factors could include EBP skills, EBP capabilities and/or self-efficacy, while cognitive predictive factors may comprise EBP knowledge as well as facilitators or barriers to learning, such as presence of mentors.

In order to identify significant predictive factors, studies were required to include a variable relating to intention to use or adopt EBP behaviours. This was determined as the outcome variable and was phrased as intention to use EBP or future use of EBP.

3.5.5 Search methods/Information sources

The timeframe for the search strategy was for studies published from 2009 to 2015. This date was chosen to align with the update to the original Sicily Statement (Dawes et al., 2005), which provided direction on categories for educational assessment to consider when designing EBP courses (Tilson et al., 2011). Studies published in English language only were considered for inclusion in this review due to lack of resources for translation. The Cochrane Library and the Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports were initially searched to ensure a systematic review had not been undertaken on the topic. The databases searched included: PubMed, CINAHL, Eric, Scopus and PsychInfo. To reduce the risk of publication bias, unpublished studies were searched for through the following databases: Mednar, ProQuest dissertations and theses and The New York Academy of Medicine. Retrieved studies were managed with use of EndNote™ reference manager software and Microsoft Excel™ files.

Initial search terms included: “evidence-based practice”, “Undergraduate”, “baccalaureate”, “college”, “student”, “predict*”, “prognos*”, “model”, “learning”. Search terms were modified slightly for individual databases with the aim of balancing sensitivity and specificity. A copy of the search strategy is attached as Appendix C and an example of the initial PubMed search is presented below:

(((quasi-experimental) OR Prospective OR retrospective OR (cohort stud*) OR (case-control) OR predict* OR prognos* OR model OR (cross-sectional) OR descriptive OR (epidemiological study designs)) AND evidence-based practice/) AND (Undergraduate OR baccalaureate OR college OR student) AND (("critical appraisal" OR knowledge OR skill OR Attitude* OR "self-efficacy" OR "self-confidence" OR value* OR behavio* OR intention OR Teaching OR Learning OR perception OR factor*[Title])) AND (("2009/01/01"[PDat] : "2015/12/31"[PDat]) AND English[lang])

In order to capture a wider range of potential studies no specific search term was applied for type of health professional course.

3.5.6 Data extraction

In order to check the reporting of the study to ensure it met criteria for prediction modelling designs, data were initially extracted using the Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis (TRIPOD) tool (Collins, Reitsma, Altman & Moons, 2015; Moons et al., 2015). The tool comprises 22 items and allows for assessment of reported outcomes, predictors and other factors that are important for reporting development and validation of prediction modelling studies. After the study was determined to be appropriate for inclusion a secondary data extraction process was undertaken regarding details of the study design, populations, methods, predictive factors and/or variables of interest as well as outcomes of significance to the review question. Specifically, details were extracted regarding participant characteristics such as age, year/level of study, previous experience with EBP, geographical location and discipline being studied. Data relating to significant and non-significant factors were extracted. Information regarding measurement tools and/or scales used and their associated reliability and validity testing, was also extracted. It was not necessary to contact any study authors for more information.

3.5.7 Selection of Studies

One reviewer (MR) initially assessed titles and abstracts for eligibility to remove any obviously irrelevant documents. Two reviewers (MR and AC) then assessed the smaller list for eligibility. Any discrepancies were discussed between the reviewers and consensus was obtained on the final number of included studies. Details of the search and selection process are reported in the Figure 3-1: PRISMA flowchart (Moher et al., 2015). A list of excluded studies is attached as Appendix D.

Search process

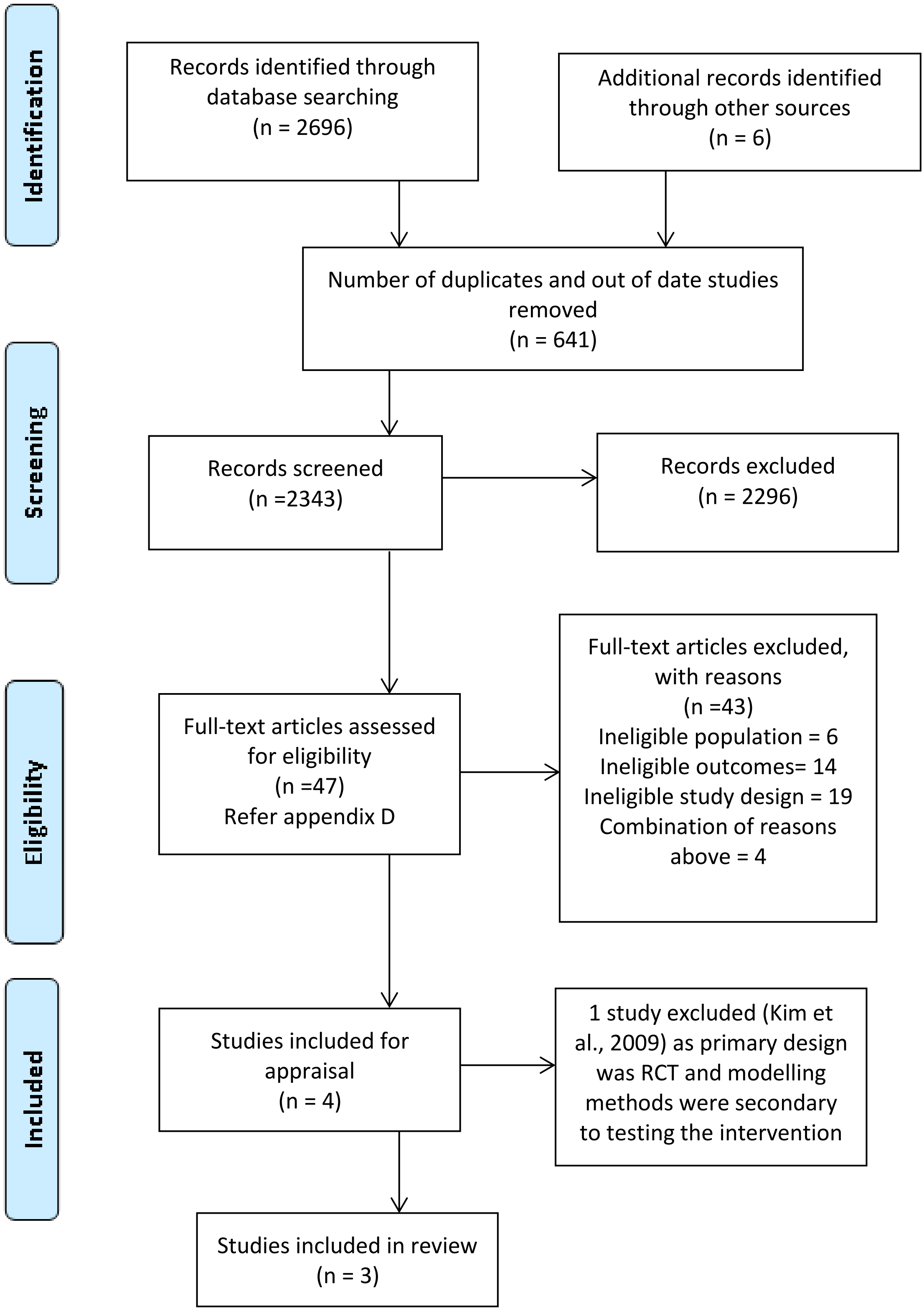

Figure 3-1. PRISMA flowchart *from*: Moher D, Liberati A, Tetzlaff J, Altman DG & The PRISMA Group (2009).

3.6 Assessment of risk of bias and methodological quality in included studies

The review followed PRISMA guidelines for reporting. As mentioned above, two reviewers independently appraised reporting of the individual studies using the TRIPOD (Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis) Checklist (Collins et al., 2015; Moons et al., 2015) to ensure the study met criteria for development and/or validation of prediction models. While assessing the papers two reviewers took notes of whether each item was present or absent and the degree to which the items were clearly explained or not. As the studies selected were all development models using one set of data only, the model validation criteria was not applicable to these studies, therefore only 18 of the checklist items are reported on for this systematic review (Refer Table 3-1).

Table 3-1

Assessment of reporting quality: Items extracted from the TRIPOD checklist (Moons et al., 2015)

Model item	Brown et al., 2010	Iovu, 2015	Forsman et al., 2012
Title	Identified as prediction study	Intention included but not prediction	Intention and prediction in title
Abstract	Clear	Brief but Clear	Clear
Background & objectives	Clear	Clear	Clear
Source of data	Clear	Unclear	Clear
Participants & setting	Clear	Clear	Clear
Outcome	Clear	Clear	Clear
Predictors	Clear	Limited	Clear
Sample size	Convenience sample	Convenience sample	Convenience sample
Missing data	Limited	Limited	Limited
Statistical analysis methods	Clear – model type not specified	Limited	Model building procedures described
Development vs. validation	Development only	Development only	Development only
Results	Sample characteristics provided; bivariate correlations between predictors reported	Limited information on sample characteristics; correlation results clearly reported	Limited information on sample characteristics but sample linked to and fully reported in previous studies; linked to theory; Model results clearly reported
Model development	Reported	Reported	Reported
Model specification	Limited	Limited	Limited
Model performance	Limited	Limited	Reported
Limitations	Clearly discussed	Partially discussed	Clearly discussed
Implications	Brief	Brief	Brief
Funding	Clear	Not found	Clear

3.7 Results

3.7.1 Characteristics of Included studies

The initial search retrieved 2978 papers. After excluding duplicates and all studies that did not meet the inclusion criteria, only 3 papers were selected for inclusion in the review (Brown et al., 2010; Forsman et al., 2012; Iovu, 2015). Two included papers (Brown et al., 2010; Iovu, 2015), explored the direct influence of the independent variables on the outcome/s while the third study (Forsman et al., 2012) explored the mediation and outcome effect of intention to use research on new graduate's intended and actual research evidence use. To achieve this, the researchers measured student's intention to use research in the final semester for the undergraduate course and subsequently measured actual research use for the new graduates, one-year post graduation (Forsman et al., 2012).

Sample characteristics and geographical details for the studies are found in Table 3-2. Year level of the students varied across the studies. Two studies were in the field of nursing (Brown et al., 2010; Forsman et al., 2012) while the third cohort was social work students (Iovu, 2015). Each study used convenience sampling techniques. Although not specifically outlined in the papers, each of the included studies achieved the most common rationale for power in prediction type studies, being "10 items per variable" Bouwmeester et al. (2012).

Table 3-2

Sample characteristics of included studies

Study	Country	Population	Age range	Year of study
Brown et al., 2010	USA	436 nursing students	20->50	Sophomore, junior and senior years
Iovu, 2015	Romania	89 Social work students	Not reported	Final semester, final year
Forsman et al., 2012	Sweden	1319 nursing students	Mean age 29.9 (SD =7.1)	Final semester final year

3.7.2 Missing data

Forsman, (2012), reported in depth how missing data was handled for their model development. Maximum likelihood expectation analysis was conducted to identify presence and patterns of missing data. Two types of missing data, specifically missing responses and 'don't know' responses were identified. Individuals with missing responses to the outcome variable and those with missing data on all predictors were excluded from the analysis and the sample size of the model was adjusted for this. Brown et al., (2010) indicated below their demographic characteristics table, that cases with missing data were excluded from their sample size, but there was no specific mention of how this was accounted for in the modelling process. There was no mention of how missing data was handled in the paper by Iovu (2015).

3.7.3 Model development and presentation

The three included papers (Brown et al., 2010; Forsman et al., 2012; Iovu, 2015) could all be described as level 1a prediction models (Moons et al., 2015) as they had obtained one data set and all the available data was used in their initial modelling. There was no evidence of model testing or external model validation.

Two studies used multiple regression analysis for developing their models (Brown et al., 2010; Iovu, 2015) while the third used a mediation analysis model, to determine impact of intention to use research as a mediating variable for use of research in practice (Forsman et al., 2012). The study by Forsman et al (2012) provided a visual representation of the full-mediated model including standardized estimates, while the other two studies reported model results in tabular format.

3.7.4 Reporting of model performance

All three papers reported R-squared values as overall model performance measures. Only one paper reported model adjustments from removing one variable after initial model development (Forsman et al., 2012). A range of model fit indices (Chi-square test, Comparative-Fit Index, Beta weights), were reported for each study and are outlined in the Findings section below. Tolerance levels, VIF values and multicollinearity assumptions were reported in two of the three studies (Brown et al., 2010; Iovu, 2015). None of the papers reported confidence intervals for model performance.

3.7.5 Predictor and Outcome variable selection

Predictor (independent) and outcome (dependent) variables from the three included studies are presented in Table 4, along with measurement scales/tools used. Selection of predictor (independent) variables was reported differently within each paper. Brown et al., (2010) identified potential predictors from responses to a demographic questionnaire developed by the authors as well as from responses to the EBP Knowledge, Attitudes and Behaviours (KAB) questionnaire (Johnston, Leung, Fielding, Tin, & Ho, 2003). Two items relating to information literacy skills were also included as they were suggested as being pre-requisites for EBP. The questions relating to these items were supported by research from Dee and Stanley (2005), Pravikoff, Tanner, and Pierce (2005) and McNeil et al., (2003). The authors clearly stated that all variables were included in the model as no prior assumptions were made (Brown et al., 2010).

Iovu (2015) selected predictor (independent) variables from the literature on EBP in the field of social work (Mathiesen & Hohman, 2013; Vimba, 2012) and reported that the variables for inclusion in the model were based on an assumption that EBP familiarity and attitudes toward EBP were associated with intention to use EBP. A 34-item scale was developed by the author to gather data. The full scale used for this study was not included in the paper but comprised domains of familiarity with EBP, EBP attitudes and intention to engage with EBP. There was no clear definition for EBP familiarity however, the items for this domain (n=10) were based on research by Rubin and Parrish (2010). Their familiarity scale comprises 10 statements such as "I know how to skillfully apply the steps of the EBP process (Rubin & Parrish, 2010, p. 637)" alongside "I feel confident in my ability to find the best research evidence to guide my practice decision (Rubin & Parrish, 2010, p. 637)". This domain formed part of a larger evidence based practice assessment scale (Rubin & Parrish, 2010) where respondents are required to complete a 5 point Likert scale for each item ranging from Strongly disagree to Strongly agree.

Forsman et al., (2012) included variables of nursing self-efficacy, EBP capability beliefs, educational gains, educational support from campus and clinical environments and research use intention in their model. As they followed students into their first year of practice, research use intention was included as an outcome (dependant) variable as well as a mediating variable for actual research use in practice. Variables included in the model were based on a systematic review of social cognitive theory based interventions that explored the relationship between intention to use research and actual research use behaviour (Godin et al., 2008). The Theory of Planned Behaviour (Ajzen, 1991, 2011) supported the variable of intention, while the variable of EBP capability beliefs was based on Bandura's self-efficacy theory (Bandura, 1997). The scale used to measure EBP capability beliefs was grounded in the five steps of EBP as reported by Sackett et al (Sackett et al., 1996; Sackett et al., 2000), and has been used in other studies to measure nurses' EBP capability beliefs (Florin et al., 2012; Forsman et al., 2012; Wallin et al., 2012). Reported reliability and validity for measurement tools used in the included studies, is reported in Table 3-3.

Table 3-3

Predictor and outcome variables for included studies with measurement scales and testing

Paper	Predictor variable/s	Measurement Tool/scale	Validity/ reliability testing	Outcome variables	Measurement Tool/Scale	Validity/ reliability testing
Brown et al., (2010)	Academic class level	Own demographic tool	-	EBP knowledge (5 items)	KAB questionnaire (Johnston et al, 2003)	Cronbach's Alpha 0.84
	Gender	Own demographic tool	-	EBP attitudes (6 items)	KAB questionnaire (Johnston et al, 2003)	Cronbach's Alpha 0.83
	Ethnicity	Own demographic tool	-	EBP future use (9 items)	KAB questionnaire (Johnston et al, 2003)	Cronbach's Alpha 0.86
	Journal subscription	Own demographic tool	-	EBP use (6 items)	KAB questionnaire (Johnston et al, 2003)	Cronbach's Alpha 0.71
	Hospital externship employment	Own demographic tool	-			
	Confidence in clinical decision making	Own demographic tool	Not reported as previously tested			
	Clinical experience preparedness	Own demographic tool	Not reported as previously tested			
Iovu (2015)	Familiarity with EBP process	Own tool (10 items)	Reliability analysis: Cronbach's Alpha 0.78	Intention to engage in EBP process	Own tool (10 items)	Cronbach's Alpha 0.67
	Attitude toward EBP process	Own tool (14 items)	Reliability analysis: Cronbach's Alpha 0.54			

Table 3-3: Predictor and outcome variables for included studies with measurement scales and testing (cont.)

Paper	Predictor variable/s	Measurement Tool/scale	Validity/ reliability testing	Outcome variables	Measurement Tool/Scale	Validity/ reliability testing
Forsman et al (2012)	Nursing self-efficacy	Nursing self-efficacy (Hagquist, Bruce, & Gustavsson, 2009);	Exploratory Factor Analysis; Loadings between0.47 and 0.80; Cronbach's Alpha 0.87	Intention to use research	One item (Estabrooks, 1999)	
	EBP capability beliefs	EBP capability Beliefs scale (Wallin et al., 2012)	Exploratory Factor Analysis; Loadings between0.78 and 0.84; Cronbach's Alpha 0.88			
	Educational gains	Adapted from National study of student engagement (Kuh, 2001)	Exploratory Factor Analysis; Loadings between0.66 and 0.84; Cronbach's Alpha 0.82	Research use behaviour	One item (Estabrooks, 1999)	Not reported but scale used previously (Henrietta Forsman, Gustavsson, Ehrenberg, Rudman, & Wallin, 2009; 2010
	Educational support for research use	Two scales developed within the LANE study (Florin et al., 2012): a) Support from campus education b) Support from clinical education	Exploratory Factor Analysis: a) Loadings between0.80 and 0.82; Cronbach's Alpha 0.76 b) Loadings between 0.56 and 0.90; Cronbach's Alpha 0.75			

3.8 Risk of bias quality assessment

To assess risk of bias, the QUIPS (Quality in Prognosis studies) tool was used (Hayden, van der Windt, Cartwright, & Bombardier, 2013). The tool comprises six domains with up to six items within each domain. Ratings of high, moderate or low bias are attributed to each domain. Results of the risk of bias screening, with reasons, are seen in Table 3-4. The QUIPS tool is attached as Appendix E.

Table 3-4

Methodological quality assessment using QUIPS tool (Hayden et al., 2013)

	Brown et al., 2010	**Iovu, 2015**	**Forsman et al., 2012**
Study participation	Moderate bias[a]	Moderate bias[a]	Moderate bias[a]
Study attrition	Moderate bias[b]	Moderate bias[b]	Low bias
Prognostic factor measurement	Moderate bias[c]	High bias[c]	Low bias
Outcome measurement	Low bias	Low bias	Low bias
Study confounding	Moderate bias[d]	Moderate bias[d]	Moderate bias[d]
Statistical analysis and reporting	Low bias	Moderate bias[e]	Low bias

[a] Relationships between predictive factors and outcomes may be different for participants and eligible non-participants due to convenience sampling method

[b] Relationships between predictive factors and outcomes may be different for participants completing study and non-completing participants due to limited reporting of attrition/non response

[c] Measurement of predictive factors may be different for different levels of the outcome of interest due to limited reporting on how predictive factors were selected, measurement tools and/or lack of information on missing data

[d] The observed effect of the predictive factor on the outcome may be distorted by another factor related to the predictive factor and outcome which is not discussed in detail, e.g. prior exposure /knowledge

[e] Limited detail on model building and reporting of result may cause results to be spurious or biased particularly in relation to limited reporting of measurement scales

(Guidance on reasons for risk of bias from Hayden et al., 2013)

3.9 Findings of the review

3.9.1 Correlations

Two of the three papers (Brown et al, 2010; Iovu 2015), reported Pearson Product Moment bivariate correlations between independent and dependent variables of EBP future use and Intention to use EBP, prior to model development. The third study (Forsman et al., 2012) reported Pearson correlations between the intention to use research as a dependent variable and the outcome variable of research use one-year post graduation. Correlations that were significant for intention to use EBP were familiarity with EBP and attitudes toward EBP (Iovu, 2015). Significant correlations for future use of EBP included confidence in clinical decision-making, preparedness for last clinical experience, journal club subscription and academic class level (Brown et al., 2010). Correlations reported in the studies are presented in Table 3-5.

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Table 3-5

Correlations between independent and dependent variables regarding development of EBP in healthcare undergraduates

		Independent variables				Dependent variables	
Study	**Variables**	**EBP Knowledge**	**EBP Attitude**	**Intention to use EBP**	**EBP use**	**EBP future use**	**Research use 1 year post graduation**
Brown et al., (2010)	Academic class level	0.153^{**}	0.188^{***}		0.160^{**}	0.152^{**}	
	Gender	0.069	0.110^{+}		0.069	-0.001	
	Ethnicity	-0.015	0.110^{+}		0.004	-0.024	
	Journal subscription	0.079	0.108^{+}		0.049	0.139^{*}	
	Hospital externship	0.079	0.136^{+}		-0.046	0.023	
	Confidence in clinical decision making	0.138^{*}	0.011		0.324^{***}	0.325^{***}	
	Clinical experience preparedness	0.139^{*}	0.104		0.314^{**}	0.353^{**}	
Iovu, (2015)	Familiarity with EBP		0.063	0.290^{**}			
	Attitudes to EBP			0.249^{*}			
Forsman et al., (2012)	Intention to use research						0.21^{**}

Pearson correlation levels of significance - $^{*}p\le0.05$; $^{**}p\le0.01$; $^{***}p\le0.001$ (Pearson's correlations); $^{+}p\le0.05$ (point bi-serial correlation)

3.9.2 Model findings

Factors significant in predicting undergraduate healthcare students' intention to use either EBP or research after graduation included familiarity with EBP, positive EBP attitudes, EBP capability beliefs and educational support. For a related but slightly different outcome, the future use of EBP, the factors that were significant in predicting this outcome were journal subscription, confidence in clinical decision-making and preparedness for clinical experience. Although each of the models reported significant factors influencing their outcome variables it was not possible to synthesise statistical results due to heterogeneity within and across the studies.

For the outcome variable of future use of EBP, 16.9% of the variance was explained by the predictor variables in the model by Brown et al., (2010) with significant associations reported between three items: journal subscription, clinical preparedness and confidence in decision-making. Although significant in the correlation analysis, student academic year was not a predictive factor for future use of EBP (Brown et al., 2010). The overall model developed by Iovu (2015) was reported as explaining 22% of the variation in Intention to use EBP, with both predictors of EBP familiarity and EBP attitudes having significant influence on the outcome variable. The full mediation model presented by Forsman et al., (2012) reported intention to use EBP had a direct effect on EBP use as well as a mediating influence toward the student's EBP capability beliefs (self–efficacy), educational support (clinical and academic) and their actual research behaviours. Only 6.6% of the variation for undergraduate student intention to use EBP was explained by the variables in the model and for research use behaviours one year after graduating, the model explained 4.5% of variation (Forsman et al., 2012). Model fit indices for the full mediation model identified a satisfactory model fit and were reported as: X^2= 11.51 (df=5, p=0.042); RMSEA (root mean square error approximation of the mean) = 0.033; CFI (Comparative fit index) = 0.94; SRMR (Standardized root mean-square residual) = 0.026 (Forsman et al., 2012; p.1160). The full model results for the outcome variables of interest to this review are displayed in Table 3-6. As a guide, indicators of accepted parameters for model indices for good fit include X^2 – non-significant result preferred (can be influenced by sample size); RMSEA < 0.06; CFI > 0.090; SRMR < 0.08 (Hooper et al., 2008; Hu & Bentler, 1999).

Table 3-6
Model regression results as reported

Study	Independent variables	Dependent variable/s	*B*; SE (*B*)	Beta	Model variance
Brown et al., (2010)	Academic class level	Future use of EBP	0.074; 0.066	0.072	$R^2 = 0.169$
	Gender		-0.017; 0.134	-0.008	
	Ethnicity		-0.020; 0.077	-0.015	
	Journal subscription		**-0.205; 0.086**	**0.139***	
	Hospital externship		-0.038; 0.073	-0.032	
	Confidence in clinical decision making		**0.160; 0.051**	**0.202****	
	Preparedness for clinical experience		**0.162; 0.044**	**0.235*****	
Iovu, (2015)	**EBP familiarity**	**Intention to engage in EBP**	**0.453**	**0.392*****	R^2=0.223
	EBP attitude		**0.190**	**0.240***	
Forsman et al., (2012)	Nursing self-efficacy			0.061	
	EBP capability beliefs	**Intention to use research**		**0.083***	*For full mediation model - variance in intention in final semester for undergraduates: R^2=0.066* *One year post graduation: R^2=0.045*
	Educational gains			0.014	
	Educational support - clinical			**0.078***	
	Educational support - campus			**0.13****	

*p≤0.05; **p≤0.01; ***p≤0.0

3.10 Discussion

The aim of this systematic review was to identify factors from across different health disciplines, influential to undergraduate student EBP development and subsequent intention to adopt EBP behaviours. The review process followed recommended practices for systematic review methods such as registering the protocol prior to conducting the review, having two reviewers independently select and appraise studies and using recognised tools (Haydn et al., 2013; Moons et al., 2015). Methods for this type of systematic review are predominantly undertaken in clinical scenarios (Croft et al., 2015; Steyerberg et al., 2013) hence applying the method to a health educational context is exploratory and as such, findings and recommendations are presented with the aim of contributing to the discussion around EBP and undergraduate students.

The few studies found in the search and selection process points to a need for further research into studies across all health disciplines to identify factors influencing undergraduate students' intention to incorporate EBP within their individual disciplines. While measuring EBP skills and knowledge will provide indicators of short-term gains, further research is needed to identify approaches for supporting sustainable EBP behaviours and ensuring capability for meeting licensing and registration mandates.

Despite research identifying intention to account for just under 30% of variation in behaviour (Sutton, 2002), it has been accepted as a potential predictor and valid outcome measure for clinical behaviours (Eccles et al., 2006; Godin et al., 2008). Despite challenges with educational studies (Cook et al., 2007; Phillips et al., 2014), investigating student intention through use of prediction modelling presents insight into factors requiring further attention within undergraduate curriculum in order for students to meet registration and licensure requirements.

3.10.1 EBP capability influencing intention

Few studies were found using modelling methods to investigate student intention to use EBP after graduation, which suggests that more research is required in this area to ascertain factors across disciplines that affect undergraduates' intention and decision to use EBP after they, graduate. Despite being unable to do any meta-analysis of statistical results of the studies, two papers identified predictive relationships between concepts of capability and intention. Forsman et al., (2012) found a small but significant relationship between EBP capability beliefs and intention to use research evidence, and Brown et al., (2010) found students feeling prepared for their clinical experience and confident in their decision making had a significant correlation with their future use of EBP. The two studies that identified these significant correlations had low to moderate risk of bias therefore these findings present some evidence that educational interventions promoting feelings of confidence and providing opportunities for students to build their beliefs in their EBP capability have some influence over the student's intention to transfer skills into their practice following graduation.

3.10.2 EBP attitudes and familiarity influencing intention

The study by Iovu et al., (2014) presented with the highest model variance (22%) with results suggesting that students with a more positive attitude toward EBP and greater familiarity with the EBP process intend to use EBP more after they graduate. The medium to large effect size (Cohen, 1992; Cohen, Cohen, West, & Aiken, 2013) suggests that the results are notable however the study had a higher risk of bias than the other two (Brown et al., 2010; Forsman et al., 2012) and therefore must be read in context. It was difficult to ascertain which items were actually represented in the EBP familiarity scale as although the authors reported using a 34 item scale the scale was based on prior research and one of the scales referred to (Rubin & Parrish, 2011) actually identifies questions relating to EBP knowledge, which was not measured as a separate outcome. A clearer representation of the items used would strengthen the overall findings, as it may be that EBP knowledge has greater influence in this construct than is currently represented. Other limitations with this study included small sample size and limited information on how the predictors were selected for inclusion in the model. Overall, the results of the study provide an avenue for further research especially in consideration of the high correlation between EBP attitudes and Intention to use EBP.

According to Ajzen (2011), a person's attitude can predict their behaviour, which has been explicated by Melnyk et al., (2008) who suggests that for EBP, a positive attitude will directly influence the effort the learner exerts toward EBP implementation. Melnyk (2013) also suggests that for students in particular the way in which EBP is taught can influence their attitude toward EBP. Attitudes toward EBP and belief in the value and relevance of EBP have been explored in the international literature across disciplines and cohorts (Bennett et al., 2011; Coomarasamy & Khan, 2004; Flores-Mateo et al., 2007; Florin et al., 2012; Ilic, 2015; Kim et al., 2009; Melnyk et al., 2004; Young et al., 2014). This current systematic review suggests that the impact of programs that focus on improving attitudes may influence student's intention to use EBP after they graduate although more studies specific to this relationship would aid in supporting this finding.

3.10.3 Educational support influencing intention

The study by Forsman et al., (2012) found some support for the variables of educational support in both clinical and academic environments as being influential to the overall model performance and student intention to use research evidence in their practice. The authors aligned the results for these items with sources of self-efficacy as promoted by Bandura (1977, 1997). Bandura's self-efficacy construct, as part of social cognitive theory, proposes that cognitive processes influence behaviours and as such, the theory has been influential to studies on student learning. Four sources that can improve an individual's self-efficacy (sometimes interchanged with capability), are promoted by Bandura (1977, 2012) namely: opportunities to practice the skill (performance accomplishments); role modelling (vicarious experiences); feedback and suggestion (verbal persuasion) and awareness of one's physiological responses to the task (Forsman et al., 2012). Gloudemans et al., (2013) aimed to validate Bandura's sources of self-efficacy in a nursing student cohort. Results of the modelling identified students were able to improve their self-efficacy from five sources, rather than four, with vicarious experiences being divided into peer and expert influences. EBP educational programs have the opportunity to incorporate each of these sources to build student EBP capability beliefs either in clinical and/or academic environments. Further exploration of the impact on peer and clinician/academic role models toward student EBP development and subsequent intention to use EBP is warranted.

Forsman et al., (2010) used outcome measures of research use behaviour and intention to use research with interchanging of the words research evidence. Although the authors did provide explanations for EBP as opposed to research utilisation in their study, the concepts of evidence-based practice and research utilization are different, yet at times, overlapping constructs (Yoder, 2014). Confusion with EBP concepts and terminology can have detrimental effects to patients (Graham et al., 2006), therefore it is imperative students are taught the differences between research utilisation and EBP. If not, it is feasible their intentions will be misguided.

3.10.4 Other factors

Journal club subscription was found to be predictive for future EBP use in one study (Brown et al., 2010). The authors used the variable to determine baseline literacy skills in the sample. Previous studies on the effectiveness of journal clubs have reported inconclusive findings with a systematic review by Ahmadi, et al., (2012) reporting mixed results for journal clubs as an effective strategy for teaching critical appraisal skills to surgical residents. While Harris et al., (2011), found in their systematic review, mixed results on the effectiveness of journal club participation for outcomes related to making clinical decisions, among undergraduate, postgraduate and health professional groups. It was determined that more research to clarify the relationship between journal clubs and the EBP process, specifically for undergraduate students is required, prior to ascertaining predictive value for intention to use EBP.

3.10.5 Limitations to the systematic review

There are several limitations to this systematic review to take into context when reading the results. As mentioned previously, systematic reviews of prediction studies present a relatively new methodology, which is highlighted as the first limitation to this review. Although guidelines for analysing prediction studies were followed (Moons et al., 2015), it is possible that for this particular topic a different appraisal tool and/or method of analysing the studies may have been more appropriate. Tools such as the Medical Education Research Study Quality Instrument (MERSQI) or the Newcastle-Ottawa Scale Education (NOS-E) (Cook & Reed, 2015) are available to measure quality of medical education studies, although the authors suggest study design may be an influential factor on quality assessment (Cook & Reed, 2015). As this review was synthesising prediction modelling studies it was determined that a tool specific to these study designs would be more appropriate. Although current guidelines for prognostic and predictive modelling synthesis are predominantly aimed at clinical contexts, this systematic review is using the framework for an educational focus. As the methodology for analysing predictive studies develops, further guidance may be identified for synthesising predictive educational models.

It is also acknowledged that although the search strategy was designed to be sensitive and specific to the topic, variation in nomenclature for modelling terminology presents the possibility that some studies were not retrieved which may have altered the results. Moons et al., (2015) highlight variation in terminology for actual models and variables included in models as well as the interchanged terms of prognostic and predictive. For the current systematic review, we were searching for predictive modelling studies however, we included search terms for prognostic research also, to increase the sensitivity of the search and capture studies fitting the inclusion criteria. There may also be predictive modelling studies from other health disciplines that were not captured in the search due to journal database indexing.

Heterogeneity within and across the studies limited our ability to synthesise data, however, the aim of predictive modelling is to identify relationships rather than actual cause and effect (Moons, Royston, Vergouwe, Grobbee, & Altman, 2009). Despite limitations with the methodology for the systematic review, the three papers included did present variables that can be attributed to influencing undergraduate students' intention to use EBP. The "intention –behaviour gap" is presented in psychology as the reason why, despite having positive intentions, some people succeed in changing their behaviour while others do not (Sheeran, 2002; Sutton, 2002). Educators from clinical and academic environments can contribute to filling this gap by instilling positive EBP attitudes and through providing opportunities for students to master EBP to improve self-efficacy and capability.

3.10.6 Implications and recommendations for teaching and practice

The quality of the evidence included in this review could be graded as low to moderate (Huguet et al., 2013), therefore any implications and recommendations for teaching and practice should be read in context of the limitations of the review. Not all model fit indices were reported in the study by Forsman et al., (2012), however, there are differing opinions regarding model fit indices (Hooper, Coughlan & Mullen, 2008). Recommendations exist for assessing model fit using more than one index (Schreiber, 2008), with consideration given to the underlying theory (Hooper et al., 2008).

This systematic review offers a platform for further discussions on curriculum to support students to build their capability beliefs and confidence regarding the clinical environment and implementing the EBP process, as these items were found to influence student intention to use EBP after graduation. Interventions based in Bandura's theory present opportunities to support students in both clinical and academic environments to improve their self-efficacy for EBP however, more research is required.

Attitudes toward EBP are influential to some degree for promoting student intention to use EBP after they graduate. This highlights the need for educational experiences to be positive and engaging and to demonstrate to students why EBP is desired to be best practice. Incorporation of clinical scenarios that are relevant to student level of practice and environment are recommended to make EBP seem relevant and achievable which will in turn support development of a positive attitude toward implementing EBP.

3.10.7 Implications for research

Further well-designed prediction modelling studies that have been tested with external data sets or tested by external researchers would also provide greater confidence in the strength of associations. Additional research on EBP interventions for undergraduate students based on social cognitive theory specifically to improve self-efficacy and/or capability is also recommended. Confounding is a known problem within education studies and poor or inconsistent reporting of confounders limits confidence in such studies (Philips et al., 2014; Cook et al., 2007), hence attention to reporting quality is also recommended.

3.11 Conclusion

Although the evidence is limited, this review has identified factors regarding capability beliefs and levels of confidence as being influential factors for undergraduate student's intention to use EBP intention after graduation. If undergraduates are expected to meet required EBP registration or licensing requirements, educational interventions should include opportunities for students to master EBP skills in clinical and academic environments. Attitudes towards EBP and support within clinical and academic learning environments, were also identified as influential however, more research is needed. It is feasible that the continued focus on teaching EBP knowledge and skills, as has been the focus for teaching health professional about EBP, does not adequately prepare students' for professional practice as their needs and motivators are different than those for health professionals. Further research into EBP specifically for undergraduate students across disciplines is still required.

The following chapter will outline the methods used for Stage 2 of the research study. Variables identified in this systematic review as well as from the underpinning theory will be used to test and validate two prediction models of factors influencing undergraduate student’s current use and intention to use EBP in practice after graduation.

Chapter 4: Methods for Stage 2

4.1 Introduction

Stage 2 of this research study examined factors relating to the development of undergraduate health students' evidence-based practice behaviours. Results from the systematic review reported in Stage 1, as well as the literature and theory, informed the second stage of this research, specifically, the development of two multivariate prediction models based on Bandura's Social Cognitive Theory (Bandura, 1977; 1997). Using the principles of Structural Equation Modelling (SEM), the models aimed to identify factors predicting undergraduates' intention to use EBP after graduation, as well as factors influencing and predictive of undergraduate students' current use of EBP during their course of learning. External validation and testing of the models was undertaken through a second round of data collection from a different cohort of students.

This chapter describes the research aims, design, setting, sample characteristics and sampling methods as well as the data collection and analysis processes for Stage 2 of this study. The model development and validation processes are also explained.

4.2 Research Aim

The aim of Stage 2 of this research study was to identify predictive factors influencing undergraduate students' intention to adopt EBP behaviours after graduation. A secondary aim of this stage of the research was to identify factors that influenced students' current use of EBP during the course of their undergraduate degree. The research questions for the study are revisited below as a reminder of the objectives for this stage of the study.

4.3 Research Questions

The research questions answered by Stage 2 of the research study were:

1. What factors predict undergraduate health students' intention to practice EBP following graduation?
2. What factors predict undergraduate health student's current use of EBP?
3. Does Bandura's self-efficacy construct provide an appropriate framework for predicting undergraduate health student's current use of EBP and/or their intention to use EBP after graduation?

4.4 Research Design

Stage 2 of this study followed a correlational research design to develop two multivariate prediction models. The aim of a predictive correlational study using model development is to forecast an outcome or behaviour by determining relationships between the outcome and one or multiple variables (Bouwmeester et al., 2012; Portney & Watkins, 2009); thus it was an appropriate design for this stage of the study. The prediction models were developed using structural equation modelling (SEM) processes, specifically path analysis, to identify relationships and influences among and between factors affecting student's intention to use EBP and the extent to which these relationships occurred (path coefficients). The initial model was based on Bandura's self-efficacy construct (Bandura, 1977, 1997), with the outcome variable of intention to practice EBP. Grounding the model in theory was the premise for the multivariate statistical model development (Byrne, 2013). The analysis determined the extent to which the model captures relationships between influential factors as well as the magnitude of the factors predicting undergraduate student's intention to use EBP after graduation. SEM was an appropriate choice for this study as the process can identify causal, direct and indirect relationships (Loehlin, 2004).

A second prediction model was developed to analyse factors influencing undergraduate health students' current use of EBP. Although the outcome variable for this model was a current behaviour (not a forecasted one), the correlational principles of SEM were still able to be used as the model was investigating the influence of several variables on a specific endpoint (Steyerberg et al., 2013). The results from the regression analyses, which were undertaken as part of the modelling process, provided further insight into the significant relationships for this model.

The design and method for developing and testing the prediction models was guided by recommendations from a systematic review on prediction model development and validation by Bouwmeester et al., (2012). The systematic review comprises 71 modelling studies from high impact journals and makes recommendations on issues such as study design, selection of predictors, participant recruitment, handling of missing values and performance measures specifically for model development and validation (Bouwmeester et al., 2012). Although Bouwmeester et al., (2012) focus on clinical prediction models, the findings can be applied to the methods used for developing the models proposed in this stage of the current research study. Educational research identifies many examples of use of multiple regression and path analysis designs for predicting student outcomes (Usher & Parajes, 2006; Zimmerman et al., 1992; Bandura, 1986). The current research study encompassed education, psychology and health disciplines and as such, an exploratory and cross-disciplinary focus was acknowledged for the proposed methods.

4.5 Setting

The setting for Stage 2 of the research was the Faculty of Health within Queensland University of Technology (QUT), Australia. Students from health disciplines within the faculty partake in practical, clinical and simulated clinical learning environments and many schools have close working relationships with professional organisations and health facilities throughout the state of Queensland.

4.6 Sample

Two samples of undergraduate Nursing and Paramedicine students were surveyed at different time points during their undergraduate degree course. These disciplines were chosen because they had the two largest health student cohorts in the university at the time. For both disciplines, EBP knowledge and skills are requirements for professional registration (Nursing and Midwifery Board of Australia, 2006; Paramedics Australasia, 2011) and both cohorts are required to complete EBP units at the university as part of their course. The EBP units are conducted separately for each health discipline but there is some overlap in content.

For example, each unit teaches steps of the EBP process and the conceptual process for EBP implementation (Sackett et al., 1996). EBP skills such as question formulation and critical appraisal are common to both units although students are required to complete different assignments according to the discipline in which they are enrolled. Students from both disciplines are offered the EBP unit in the second year of their degree, although some students entered the degree course with up to one-year advanced standing for entry. Hence, these students, although officially allowed to enrol in second year subjects, were actually in their first year at the university.

In 2016 there were approximately 443 final year nursing students enrolled in second semester at QUT, however only 176 Paramedicine undergraduates were enrolled at the same time. Some students were competing double degrees in nursing and paramedicine and some students were enrolled in other double degree undergraduate courses (e.g. nursing and public health), however all students were eligible for participation. Due to the different student numbers enrolled in each discipline it was decided that each episode of data collection would comprise students from both disciplines combined, as a generic ‘health undergraduate student’ cohort. This aligned with the aim of the study to examine concepts from a cross-discipline or generic view.

4.7 Sampling method and recruitment

Convenience samples of undergraduate students from the two schools of Nursing and Paramedicine were invited to participate in an online survey, at two separate time points. The survey comprised five validated scales as well as a demographic data collection instrument. The questionnaire was developed using Key Survey™ software, which is an online questionnaire development and support service exclusively available for QUT staff and higher degree research students (http://survey.qut.edu.au/site/). The service complies with QUT's privacy policy and respondent's anonymity was assured.

For both episodes of data collection, the survey was advertised online via the university web-based learning management system, on unit sites specific to nursing and paramedic students. A few weeks before commencement of the semester, the researcher met with the unit coordinators to explain the study and obtain permission to place announcements on the system as well as permissions for posting weekly reminders throughout the data collection periods. The researcher also introduced herself to the students and presented a short information session prior to their lectures just before commencement of the data collection period. Weekly reminders were sent via the learning management system, email and face-to-face by attending student tutorials during the data collection period. Data collection commenced at second week of first semester for the first episode of data collection and at the second week of second semester for the second episode. It was initially thought keeping the survey open for minimum of three weeks would be sufficient for each data collection episode, however, there were several other university surveys being conducted on the students during the semester for various other topics (e.g. other PhD students, university-distributed student engagement surveys). Consequently, the researcher was mindful of timing of the data collection to avoid survey burden, which could influence response rates. Two samples from different time points were required in order to validate the first prediction model with a separate group of similar participants to that used to develop the model (Bouwmeester et al., 2012).

In order to determine sample size for the study, the number of variables in they hypothesised model needed to be determined. The following section explains the development of the hypothesised model, which will then be followed by information pertaining to the sample size for the research.

4.8 Hypothesised prediction model

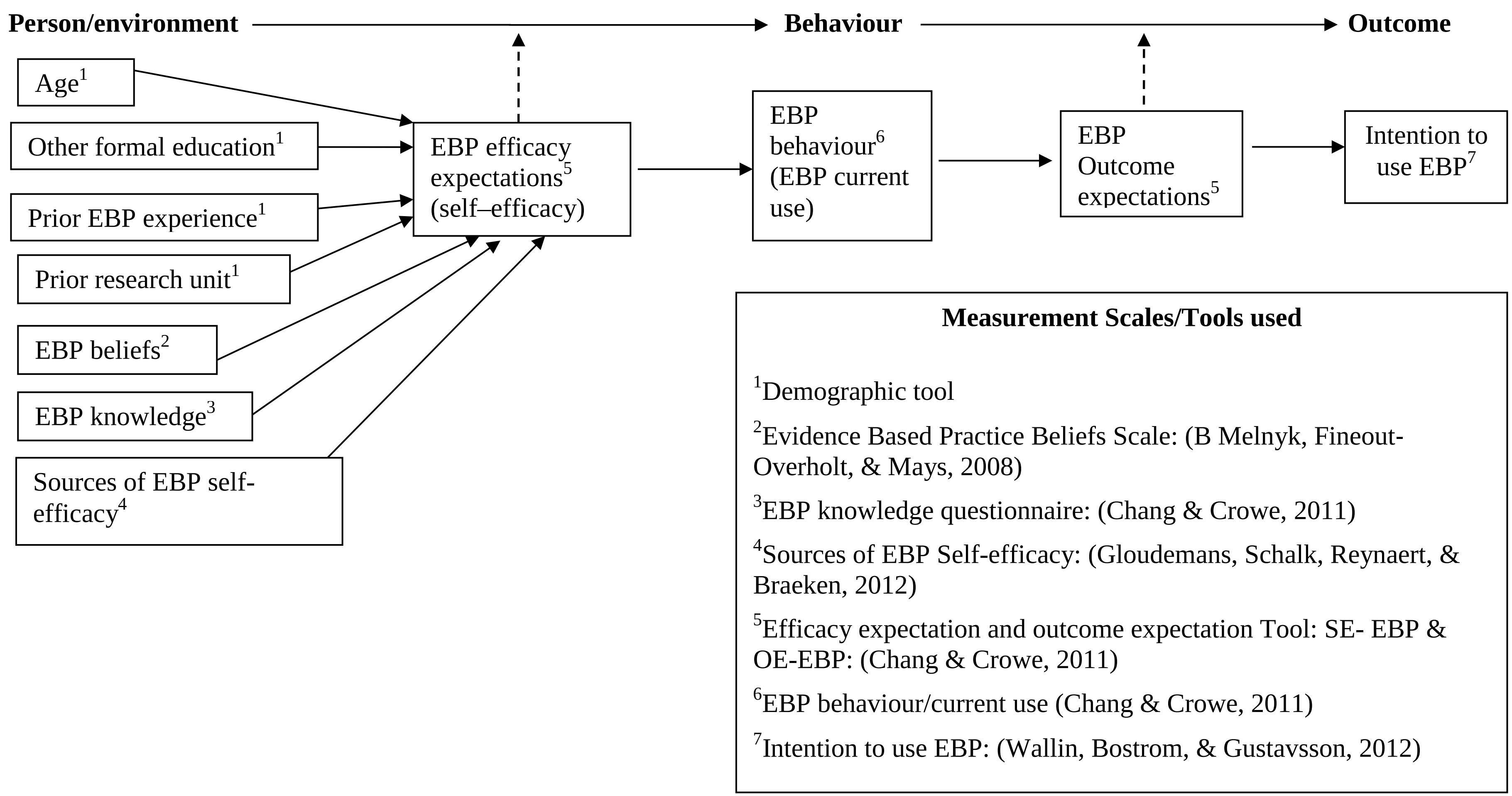
The underlying premise for model development in this study was Bandura's social cognitive theory (Bandura, 1997, 2012), which proposes that human functioning results from a combination of personal, environmental and behavioural factors (Refer section 2.9). Therefore, variables for inclusion in the initial model comprised individual and behavioural factors that were hypothesized to affect outcomes, as found in the systematic review reported in Chapter 3 and from the theory.

The independent variables (predictor variables) identified from the systematic review as influencing undergraduate health students' intention to use EBP included: familiarity with EBP, EBP attitudes, EBP capability beliefs and educational support from clinical and academic environments. EBP familiarity was not clearly defined in the systematic review therefore for the hypothesised model the variables of EBP knowledge and EBP beliefs were included instead of familiarity. When further analysing the concept of EBP familiarity many of the concepts related to EBP knowledge and attitudes (Iovu, 2015; Rubin and Parrish, 2010). Other variables included in the hypothesised model are discussed in more detail in the following sections.

Educational assessment categories for measuring domains of EBP as outlined by Tilson et al., (2011), were also considered for inclusion in the model, identifying some overlap with the findings of the systematic review presented in Chapter 3. Tilson et al., (2011) recommend considering EBP attitudes, EBP self-efficacy, EBP knowledge, skills, behaviour and reaction to the educational activity when assessing EBP learning as these categories reflect differing facets involved in developing EBP competency and are relevant to each step of the EBP process.

Support for undergraduate students within clinical and academic learning environments was measured and determined according to sources of self-efficacy (Bandura, 1977), to fit with the theory underpinning the model. Such sources comprise, modelling, feedback, mastery experiences and an awareness of physiological responses. According to Bandura even if an environment is perceived to be threatening, an individual with high self-efficacy for a task will be able to overcome such threats (Bandura, 1977). Undergraduate students in health disciplines learn in diverse environments, therefore it was determined to be more relevant to measure the learner's response to the environment according to the theory (as sources of self-efficacy). This also aligns with educational categories proposed by Tilson et al., (2011) and theory underpinning the model. According to Bandura, outcome expectations and efficacy expectations also affect behavioural outcomes (Bandura, 1977, 1997, 2012). The initial hypothesised model is seen in Figure 4-1.

Figure 4-1. Hypothesised model (adapted from Bandura, 1977).



4.9 Model variables and data collection Instruments

Despite the presence of multiple tools to measure EBP skills and behaviours (Shaneyfelt et al., 2006), no single generic tool was found to be suitable for measuring these hypothesised factors for the undergraduate student population. Consequently, different tools were used for each variable as indicated. Support for each variable and subsequent method of data collection is discussed in the sections below. A summary of measurement scales used is included at the end of this section, as Table 4-1.

4.9.1 Dependent variable for hypothesised model

The dependent variable for the primary hypothesised model was Intention to use EBP. Intention can determine future behaviours (Ajzen, 1991; Forsman, et al., 2012). While it is not observed behaviour, Eccles et al. (2006), propose that self-reported or stated intention is appropriate as an end measure of health professional behaviour, in intervention modelling. Their systematic review analysed ten studies exploring relationships between intention to perform behaviour and the actual behaviour with a total sample of 1623 health professionals. Behaviours included hand washing, adherence with universal precautions, patient education, drug prescribing behaviours, documentation of patient records and behaviours associated with pharmacy care. Results supported the use of intention as a suitable substitute for actual behaviour, particularly when supported by a theory-based framework (Eccles et al., 2006).

Godin et al. (2008) also examined different health professionals' intention and behaviours in their systematic review of behavioural intention based on social cognitive and behavioural theories. Studies selected in the review were examined for efficacy of factors that predicted behaviour. Intention to undertake a certain clinical behaviour was measured in 72 of the included studies and the Theory of Planned Behaviour (Ajzen, 1991) was found to be most congruent with supporting behavioural intention for health professionals. Behaviours measured in the included studies comprised adherence to clinical guidelines, patient support and counselling, drug prescribing behaviours, activities related to referring patients and clinical care behaviours such as patient assessment and pain management. Variables found to influence intention, included beliefs about capability to perform the particular behaviour and past behaviours or habits (Godin et al., 2008). Variations between professional discipline, sample size and behaviour category were found to be the greatest influences on predicted and /or intended behaviour, however it must be highlighted that this study was measuring clinical behaviour and the authors clearly stated that student behaviours were excluded from this review (apart from medical resident doctors). The rationale for exclusion was that student behaviours were not seen as clinical behaviours, which although not definitive, may be implying that student behaviours were determined as learning experiences rather than professional practice (Godin et al., 2008).

Intention is an integral part of implementation research as it can indicate the amount of effort a person is willing to commit to a specific behaviour (Eccles et al., 2006; Ajzen, 1991). Intervention modelling in health research studies (including systematic reviews) suggests intention is a suitable measure to investigate why individuals behave as they do (Eccles et al., 2006; Godin et al., 2008; Bostrom et al., Sheeran, 2002).

Wallin, Bostrom and Gustavsson (2012) initially developed the scale used in this research for measuring Intention to use EBP. Their five-item scale, based on Bandura's self-efficacy construct measured nurses' beliefs in their capability to practise EBP. The scale has been developed according to the five steps of the EBP process but comprises six items as the step of finding information has been divided into two categories; firstly using databases and secondly, using other information sources (e.g. books, journals, asking colleagues). Content validity of the original scale identified measures between 0.8 and 1 for each items and further testing of the scale was undertaken examining hierarchical influences of the responses in a population of practicing nurses. Factor analysis confirmed items in the scale reflected a single dimension, however for the nursing population a sequential reordering of the questions was identified in relation to the results of nurses' capability for each item (Wallin et al., 2012).

Permission was granted from the authors to modify the scale to measure undergraduates' intention to use EBP. The only modifications made to the scale were to the tense used for asking the questions and the response format. As the aim was to capture student intention to use EBP, the questions were preceded with a heading of "After graduation I intend to…" and four response options were provided relating to the extent to which students intended to complete each item. A copy of the scale is included as Appendix F.

4.9.2 Independent variables included in hypothesised model

The hypothesised model initially included 10 independent (or predictor) variables. Each variable is discussed below with examples of support for their inclusion. Some of the supporting studies are from health professional or post graduate student populations due to the limited equivalent studies specifically for undergraduate students and EBP. The measurement method for each variable is also included and a summary of the measurement scales is found in Table 4-1.

4.9.2.1 Age

Studies have identified a relationship between age and EBP beliefs yet it is unclear if the relationship is significant. Melnyk and colleagues (2008) found in a nursing population, strength of beliefs in EBP increased with age. In another nursing study of 443 Korean nurses, Hwang & Park (2013), aimed to identify associations between individual and work related factors and the nurses' perception of EBP. Increasing age was found to be significantly associated with increased EBP knowledge and skill. In contrast to this, Simpson et al., (2012) reported on a survey of paramedics, that junior and less experienced paramedics had stronger beliefs in EBP and were more positive toward promoting and adopting EBP. In a multi-disciplinary cross-sectional study of 918 allied health undergraduate and postgraduate students, increased age was significantly correlated with higher scores in EBP outcomes (McEvoy et al., 2010). The study compared profiles of the sample according to age and gender as well as EBP outcomes of sympathy, relevance, practice, terminology and confidence. EBP sympathy in this tool was explained as the person's perception of how EBP fits within their work context, EBP relevance referred to the value placed on EBP, practice equated to EBP use and terminology aligned with the individuals' knowledge and understanding of research concepts. EBP confidence included components related to skill capability.

Including the variable of Age in the hypothesised model will assist in determining significance of any relationship between age and the outcome of Intention to use EBP for the sample in this research study. Age was measured as part of the demographic questions and respondents were able to select their age from a drop down list of numbers (range 17-60), with options of 'over 60' and 'prefer not to say'. Age was collected as continuous data to enable further analysis. The demographic data collection tool is attached as Appendix G and has not been previously tested.

4.9.2.2 Other formal education

This variable was included as part of the demographic characteristics in order to provide clear information as to whether the students were undertaking their first undergraduate degree or if they had completed an postgraduate certificate, diploma, Masters or PhD qualifications. It is feasible that despite being enrolled in and undergraduate course, some had completed other formal education programs, providing them prior experience or knowledge in EBP or topics related to EBP. It is not known if previous formal education has any significant relation to student intention to use EBP as this level of detail is often absent in reporting of sample characteristics in educational studies (Cook et al., 2007), yet it may be a confounder for outcome results.

The variable of ‘other formal education’ was measured via a yes/no response in the demographic data collection tool (Refer Appendix G) and was subsequently coded as dichotomous data. There was an option of providing further detail of the type of formal education such as other certificate, diploma, bachelor degree or postgraduate qualification however this information was included for the descriptive analysis only.

4.9.2.3 Prior EBP experience

Previous research by Melnyk and colleagues (2008), identified correlations between practising nursing staff with prior exposure to EBP and their beliefs of EBP as well as their self-report of EBP implementation. Nurses with previous EBP exposure had higher scores on the implementation scale; however, there was no statistically significant difference between those with prior exposure and those without, in relation to EBP beliefs. Previous experience with and/or exposure to EBP has been suggested as a factor differentiating undergraduate and postgraduate student EBP knowledge (Coomarasamy & Khan, 2004).

This variable was measured as a dichotomous data through a ‘yes/no’ answer to the question “Other than your university classes regarding evidence-based practice (EBP), have you had any other experience or formal training in EBP?” An example was provided whereby the student may have current or prior employment in an environment where EBP is supported. The question was part of the demographic questionnaire (Refer Appendix G).

4.9.2.4 Prior research unit

This variable was included as part of the demographic characteristics in order to identify any significant differences between students who may have completed research units and those who had not. Entwistle (1998) stresses the importance of finding out what students already know about a subject to ensure understanding of foundational concepts consequently, this variable was included to identify the base in which individual student EBP knowledge was grounded.

To measure this variable, students were asked on the demographic questionnaire (Refer Appendix G), if they had completed a prior research unit such as general research methods, epidemiology or health statistics. Responses were measured through a yes/no response in the demographic data collection tool and coded as dichotomous data. A second question regarding this variable was included in the demographic questionnaire which asked students it they had fully completed the required EBP unit for their course. At the time of the survey, the EBP units were only available to second year students, however if the student was enrolled with advanced standing for their course it was feasible that some were technically in their first semester of university (i.e. second year, graduate entry students). The third year students from both cohorts should have completed their EBP unit by the second episode of data collection. This extra information was for descriptive analysis only, to identify any discrepancies with year level and EBP unit.

4.9.2.5 EBP Beliefs/Attitudes

Although attitude and belief are often reported as similar concepts, there are differences between the two, whereby an attitude is considered a person's evaluation of a concept while a belief implies an individuals' perception of probability toward something (Fishbein & Raven, 1962). A change in attitude can lead to a change in beliefs and subsequent effect on a person's self-efficacy (or efficacy beliefs).

The variable of EBP attitudes toward EBP was identified in the systematic review in Stage 1 of this research as having some influence toward EBP intention. The evidence was limited however due to inadequate representation of the measurement scales used. The terms 'beliefs' and 'attitudes' are often used interchangeably in relation to EBP however, for the model we chose to measure EBP beliefs to represent the value held by the student regarding the usefulness of EBP (Tilson et al., 2011). Many EBP studies across different disciplines have reported interventions to improve EBP attitudes in health professional and students (Flores-Mateo & Argimon, 2007; Ilic & Maloney, 2009; Young et al., 2014), however few have investigated any impact EBP beliefs have toward adoption of EBP behaviours. Attitudes are a predictor for behaviour (Ajzen, 1991, 2011; Tilson et al., 2011) and underlying beliefs may influence a person's use of EBP (Godin et al., 2008; Melnyk, et al., 2008; Tilson et al., 2011). Including EBP beliefs in the model will identify if it is influential toward student intention to use EBP after graduation.

EBP beliefs were measured using the 16 item, EBP Beliefs Scale, developed by Melnyk, Fineout-Overholt & Mays (2008). The tool was originally tested in a cohort of practicing nurses (Melnyk et al., 2008), and has since been validated more extensively in nursing cohorts as well as in the field of social work (Rice, Hwang, Abrefa-Gyan, Powell, 2010). The scale was chosen as it is a theory-based scale with a focus on the individuals' belief in the value of EBP implementation and is able to be applied to an undergraduate population. The response format includes a 5 point Likert scale where respondents are asked to rank their responses from 1 (Strongly disagree) to 5 (Strongly agree). Reliability and validity testing of the tool using Principal Components Analysis (PCA) identified all items fitting within a single construct (Melnyk et al., 2008) and Cronbach's $\alpha > 0.90$ for the scale (Melnyk et al., 2008). Permission has been granted to use the tool from the authors (Refer Appendix M). Due to copyright restrictions, the tool is not able to be published (Melnyk et al., 2008).

4.9.2.6 EBP knowledge

EBP knowledge is traditionally based on knowing the five steps of EBP identified by Sackett et al. (1996). Teaching undergraduates the knowledge required for EBP may vary across institutions, disciplines and levels of practice. Bandura (1993) however, asserts that knowledge and cognitive ability are not enough to determine one's capability at a particular task, especially under difficult circumstances. More specifically for EBP, having knowledge of the steps of the process may be different to being able to implement such steps in clinical practice, as evidenced by the lack of uptake of EBP by health professionals (Graham et al., 2006; Grimshaw et al., 2012; Grol & Grimshaw, 2003, Ciliska, 2005). Previous research, including systematic reviews on EBP teaching strategies for health professionals and/or students, identify multiple studies measuring EBP knowledge (Coomarasamy & Khan, 2004; Coomarasamy, Taylor & Khan, 2003; Flores-Mateo & Argimon, 2007; Melnyk et al., 2004; Taylor et al., 2000; Young et al., 2014) however, reports of low EBP implementation suggest factors other than knowledge are influential.

Although there are many scales available to measure EBP knowledge in health professionals, many of these tools are not suitable for a student population, or for testing across different disciplines. Chang & Crowe (2011) developed a generic, objective EBP knowledge tool. The tool is brief, (7 items) and although not psychometrically tested, has been tested on Registered Nurses and Midwives (Chang & Crowe, 2011), and validated in studies on allied health professionals from several disciplines (Wilkinson et al., 2012). The questions are suitable for an undergraduate level as they are based on the fundamental principles of the five-step model of the EBP process (Sackett et al., 1996). As the main focus for this research study was self-efficacy, a pragmatic decision was made that the benefits of a shorter, generic tool would override using more lengthy and discipline specific tools such as the Berlin (Fritsche, Greenhalgh, Falck-Ytter, Neumayer, & Kunz, 2002) and Fresno (Ramos, Schafer, & Tracz, 2003) tools. The Berlin and Fresno tools primarily use medical scenarios to test EBP knowledge. The Fresno tool has been modified for to test EBP knowledge in physiotherapists (Tilson, 2010) and physiotherapy students (Bozzolan et al., 2014) however, neither tool aligned with the underpinning theory and focus for this current research. Permission was granted to use the tool by the primary author and it is attached at part of Appendix H.

4.9.2.7 Sources of EBP self-efficacy

Bandura's social cognitive theory (SCT) proposes that self-efficacy can be enhanced through four information sources, namely – verbal persuasion, mastery of tasks, vicarious experience and emotional responses to the situation (Bandura, 1977, 1997). How one reacts to these information sources can determine their actions and behaviours. Educational programs based on SCT taking into account the self-efficacy construct, have potential to be more successful than programs that do not use the framework, however further research must be done in this area (van Dinther et al., 2011).

Early work on incorporating the information sources within educational programs, found students raised their self-efficacy expectations on a specific task, and subsequently influenced academic outcomes. A study by Usher and Parajes (2009) aimed to create a valid tool to measure Bandura's four sources of efficacy information as applied to middle school maths students and found that for their study, mastery experience was the most powerful source of self-efficacy, with the other three sources being influential but to a lesser degree (Usher & Pajares, 2009).

Role modelling is an example of Bandura's self-efficacy information sources, namely vicarious experience. In healthcare, Profetto-McGrath (2005) suggests that role modelling is intrinsic to developing critical thinking as an essential skill for undergraduates to learn EBP. A study by Gloudemans et al. (2013) investigated the most relevant source of self-efficacy for nursing students to develop their critical thinking skills within clinical learning environments. Results found in nursing students, self-efficacy beliefs were primarily determined by vicarious experience, however further analysis differentiated peer-experiences and expert experiences, with the authors suggesting either source can impact on professional development (Gloudemans, 2013; Gloudemans et al., 2013). The study identified that for nursing students; verbal persuasion and awareness of physiological response were the most predictive sources of self-efficacy, which the authors felt were a reflection on the experiential learning process (Gloudemans, 2013; Gloudemans et al., 2013). Elements within the undergraduate learning environment may facilitate some or all of these sources to develop self-efficacy beliefs thereby improving critical thinking skills and subsequent and EBP behaviours.

Rather than measuring specific characteristics of the learning environment, this research will measure self-efficacy sources within clinical and/or academic environments. The evidence for including learning environment as a factor in the model was not strongly supported by the systematic review (Refer Chapter 3), however as part of the theory underpinning this study, sources of self-efficacy is an appropriate variable to measure (Bandura, 1977, 1997). There are elements of the sources of EBP self-efficacy such as facilitation, feedback and opportunity for mastering skills, which can provide an insight into the influence of the environment on the student.

Sources of EBP self-efficacy will be measured using the five-factor model developed and tested by Gloudemans et al. (2013). The original tool was developed to measure undergraduate self-efficacy in a teaching course and was based on the four sources of self-efficacy as stated by Bandura (1977, 1997), namely mastery of tasks, vicarious learning experiences, verbal persuasion and physiological manifestations. As mentioned above, Gloudemans and colleagues (2013) found that vicarious experiences could be broken into two factors, peer and expert learning experiences. The tool has been previously tested on 230 nursing students and confirmatory factor analysis supported development of the five-factor model (factor loadings >0.40). The results of the study highlighted the importance of mentoring for nursing students by peers and role models within their clinical placements. Permission has been obtained to use the tool and the tool is attached as Appendix I.

4.9.2.8 EBP self-efficacy

EBP Self-efficacy refers to a person's judgement that they can perform the steps within the EBP process. Self-efficacy is one priority category recommended for inclusion in any EBP learning assessment tool (Tilson et al., 2011). According to Bandura, self-efficacy is task specific and can be broken down into two entities - efficacy expectations and outcome expectations. Efficacy expectation refers to the persons' belief in their ability to perform a specific task. The term is often interchanged with self-efficacy and/or capability beliefs (Forsman et al., 2012; Wallin et al., 2012)

Despite recommendations for assessing self-efficacy in EBP (Tilson et al., 2011), few studies have measured student or health professionals' EBP self-efficacy (Artino et al., 2012; Lee & Schmaman, 1987; Spek et al., 2013a; Spek et al., 2013b). Abrahamson, Arling & Gillette (2013) explored the relationship between clinical EBP self-efficacy and EBP implementation through structural equation modelling in a sample of clinicians across several health care organisations across America (n = 236). A statistically significant correlation was found between self-efficacy and acquiring evidence (β=0.485, $p<0.001$) and from acquiring evidence to applying evidence in practice (β=0.698, $p<0.001$). The authors suggest that clinicians with positive self-efficacy for the skills of EBP would be more likely to implement such behaviours.

Self-efficacy is sometimes reported as self-confidence or capability beliefs. Wallin et al., (2012), reported on EBP capability beliefs as part of a longitudinal study of 1256 nurses. The sample was tested on application of EBP as well as beliefs of their capability in using research. Results found that the nurses who held higher beliefs of their EBP capability reported higher use of research in practice. Tucker et al. (2009) have also explored self-efficacy in EBP through developing their own scale to measure EBP self-efficacy in a nursing population. Their study did not measure outcome expectancy as it was based on published EBP models and organisational factors rather than self-efficacy theory.

The Self-Efficacy for Evidence Based Practice (SE-EBP) scale (Chang & Crowe, 2012) was used to measure student self-efficacy. Items within the tool are based on the 5-step EBP process (Sackett et al., 1996) and Bandura's (1977, 1997) self-efficacy construct. The tool can be used as a generic measure of health professionals' EBP self-efficacy and has been tested for construct validity through exploratory factor analysis (Chang & Crowe, 2011). Reliability and validity testing has been undertaken in a sample of Registered Nurses and Midwives (Chang & Crowe, 2011) and allied health professionals (Wilkinson et al., 2012). Factor analysis (specifically, principal axis factoring) identified three subscales within the tool namely: 1) identifying the problem, 2) searching for evidence, and 3) implementing the evidence (Chang & Crowe, 2011). Although only having three subscales, the third subscale comprises 12 items relating to apprising, implementing and evaluating

EBP (Chang & Crowe, 2011; 2012). Reliability testing of the scale identifies Cronbach's $\alpha = 0.97$ for the entire scale with Cronbach's $\alpha > 0.91$ for each subscale (Chang & Crowe, 2011). The SE-EBP tool measures levels of confidence in undertaking EBP related tasks. The wording from the original tool was modified slightly to suit undergraduate students and permission to use the tool has been obtained from the author. An updated version of the original 26-item SE-EBP tool comprises 28 questions, which are based on the five steps of the EBP process and are answered with a Likert Scale of 0-10, with a score of 10 reflecting "extremely confident" and a score of zero (0) meaning " no confidence at all" (Wilkinson et al., 2012). Permission was obtained to use the scale from the primary author and it is attached as Appendix J.

4.9.2.9 EBP outcome expectancy

A separate entity from self-efficacy, outcome expectancy refers to the individual's belief of the consequence of performing the task (Bandura, 1977, 1997). It is important to measure the constructs of self-efficacy and outcome expectancy separately as it is possible that if a person believes their action will have negative consequences (the expected outcome) than they may choose not to undertake the action (Bandura, 1977). Alternatively, even if a person feels confident of being able to perform a task (high self-efficacy), if they believe it will have a negative consequence to themselves or others (outcome expectancy), then they may choose not to perform the task. Very few studies that measure self-efficacy actually measure outcome expectancy as well.

The Outcome Expectancy for Evidence Based Practice Scale (Chang & Crowe, 2011) will be used to measure EBP outcome expectancy. The OE-EBP measures how confident the respondent is that the EBP task they undertake will achieve the desired outcome. The tool comprises eight questions and respondents reply on a Likert Scale where zero (0) reflects 'Not confident at all" and 10 reflects "extremely confident". The tool has been validated in studies on nurses and midwives (Chang & Crowe, 2011) as well as allied health professionals (Wilkinson et al., 2012). Initial reliability testing identifies Cronbach's $\alpha > 0.97$ and the scale was able to distinguish between the two constructs of outcome expectancy and efficacy expectations (Refer table 4-1). Permission has been obtained from the primary author and the tool is attached as Appendix K.

4.9.2.10 EBP current use (behaviour)

Current EBP behaviour will be included as an independent variable in the model of factors influencing student intention to use EBP but is will also be a dependant variable for the second model. Brown et al., (2010) reported nursing students' use of EBP was higher in initial years of their course and decreased in their final year. While Forsman et al., (2012) reported that newly graduated nurses' use of research evidence was lower in their first year of practice than intended prior to graduation. EBP use is often measured as use of literature searching and/or and appraisal skills rather than use of all steps of the EBP process (Sackett et al., 1996). Accordingly, Current EBP use will be measured with a scale developed by Chang & Crowe (2011). The tool is based on the steps of the EBP process (Sackett et al., 1996) and comprises 8 items with a Likert scale response format. The tool has not yet been psychometrically tested but is suitable as a generic measure (not discipline specific) and has been validated in studies of nursing and other disciplines to measure EBP behaviours (Chang & Crowe, 2011; Wilkinson, et al., 2012). The tool is attached as Appendix L.

4.9.3 Other data collected

4.9.3.1 Discipline being studied

Data on discipline being studied was collected as part of the demographic descriptive characteristics (Appendix F) and was not a separate variable in the model. Due to the different numbers between the two cohorts of nursing and paramedicine students, and the aim of testing the model in a cross-disciplinary manner, all complete data was used regardless of actual discipline being studied. Participants were asked to select their field of practice from a set list, which included Nursing or Paramedicine, double degree (nursing and paramedicine) or 'other'. Although not directly measuring EBP, a Cochrane systematic review identified some positive effects from interprofessional education programs on professional practice behaviours and recommended more studies be undertaken to identify key constructs within such programs (Reeves et al., 2008).

4.9.4 Summary of measurement tools

This section has presented the tools used for measuring the variables for developing the prediction model. A summary of the measurement tools is presented as Table 4-1. Permission for use of measurement scales as obtained from contacting original authors, are attached as Appendix M. Table 4.2 identifies the response scale format, number of items and minimum and maximum scores for each measured variable.

Table 4-1
Summary of Measurement tools

Variable being measured	Measurement Tool/scale	Author	Validity/reliability testing
Age, Other formal education, Prior EBP experience, Prior Research unit	Demographic tool	Ramis, Chang & Nissen, 2014	Not previously tested –for descriptive analysis only
EBP beliefs	Evidence Based Practice Beliefs Scale	Melnyk, Fineout-Overholt, & Mays (2008)	PCA identifed single construct; Cronbach's α >0.90
EBP knowledge	EBP knowledge questionnaire	Chang & Crowe, (2011)	Not psychometrically tested. Validated in samples of nurses and midwives and allied health professionals
Sources of EBP Self-efficacy	Sources of EBP Self-efficacy	Gloudemans, Schalk, Reynaert, & Braeken (2012)	CFA; factor loadings> 0.40
EBP efficacy expectations (self–efficacy)	Efficacy expectation Tool: SE- EBP	Chang & Crowe, (2011)	EFA; Cronbach α = 0.97 for whole scale; Cronbach α >0.91 for each subscale
EBP behaviour (EBP current use)	EBP behaviour/current use	Chang & Crowe, (2011)	Not psychometrically tested. Validated in Allied health professionals.
EBP outcome expectancy	Outcome expectation Tool: SE OE-EBP	Chang & Crowe, (2011)	EFA; Cronbach α = 0.97 for whole scale; Cronbach α >0.91 for each subscale
Intention to use EBP	Modified from EBP tool	Wallin, Bostrom, & Gustavsson, (2012)	CFA; item loadings 0.77-0.97

Table 4-2

Total possible scores for measurement scales for Stage 2

Variable	Min total possible score	Max Total possible score	Number of items	Response scale format
EBP Beliefs overall	0	64	16	Likert scale range 0-4
EBP self-efficacy overall	0	280	28	Likert scale range 0-10
EBP self-efficacy subscale 1: identifying the problem	0	50	5	Likert scale range 0-10
EBP self-efficacy subscale 2: searching for evidence	0	90	9	Likert scale range 0-10
EBP self-efficacy subscale 3: implementing the evidence	0	140	14	Likert scale range 0-10
EBP Outcome Expectancy overall	0	80	8	Likert scale range 0-10
EBP use overall	8	56	7	Likert scale range 1 -8
Sources of EBP self-efficacy overall	0	88	22	Likert scale range 0 - 4
Sources of EBP self-efficacy subscale 1: Mastery	0	20	5	Likert scale range 0 - 4
Sources of EBP self-efficacy subscale 2: Vicarious learning experiences	0	16	4	Likert scale range 0 - 4
Sources of EBP self-efficacy subscale 3: Vicarious learning peers	0	16	4	Likert scale range 0 - 4
Sources of EBP self-efficacy 4: verbal persuasion	0	16	4	Likert scale range 0 - 4
Sources of EBP self-efficacy subscale 5: physiological symptoms	0	20	5	Likert scale range 0 - 4
EBP knowledge	0	10	10	Multiple choice Q. 1-10
EBP Intention overall total	4	24	6	Likert scale range 1-4

4.10 Sample size

There are several views concerning sample size for prediction modelling, which have changed over the years, and sample and effect size calculations are not as straightforward as for randomised control trial studies. According to Peduzzi, Concato, Kemper, Holford, & Feinstein (1996), the sample size for modelling studies should account for a minimum 10 events or cases per variable to provide results that are more reliable. Schumaker and Lomax (2004; 2012) suggest that many researchers using structural equation modelling (SEM) use sample sizes between 250 and 500 participants with agreement that the larger the sample size, the more stable the model validation. More recently, Bouwmeester et al. (2012), found in their systematic review on prediction studies, that many researchers still use the '10 events per variable' rationale, however they add that the actual power of the study is determined by the "number of participants in the smallest group (Bouwmeester et al., 2012, p. 5)." For the proposed model, there are currently ten independent continuous variables; therefore, following the recommended 10 per variable rule, an initial minimum sample of 100 per group would be required.

There are known limitations to sample size for online student surveys such as low response rates and variability in responses across institutions (Porter & Umbach, 2006), with response rates of around 40% being common within higher education settings (Laguilles, Williams, & Saunders, 2011; Millar & Dillman, 2011). To allow for 60% non-response, the adjusted sample size for each group should ideally be a minimum of 400 participants for each cohort for the complete hypothesised model. This initial sample size is however, based on inclusion of all hypothesised variables being included in the model. Only the variables that are significantly correlated to the outcome variable will be included in the model development process therefore the necessary sample size to achieve adequate power may be smaller than initially anticipated for both episodes of data collection. Consequently, the 10 per variable guide as proposed by Bouwmeester et al., (2012) is the goal for sample size for model development and validation procedures.

4.11 Data collection period

After ethical approvals were obtained, the first episode of data collection commenced. Data were collected from undergraduate students in the School of Nursing and School of Clinical Sciences. The first round of data was collected from second year students in both disciplines from week two to five of first semester (Feb-March 2016). The second collection occurred from weeks 2-8 in second semester (July-August, 2016) and was targeted to students who were in their third or final semester of their course, i.e. students' were approximately 12 months ahead in their training compared to students in the first sample. The data collection period for the second episode was extended for a total of six weeks due to students being off campus as part of their clinical placement requirements. Extending the data collection period allowed more time for students to check their email accounts for the invitation to the survey. It also enabled time to approach the students on campus, after their clinical rotations, which occurred in weeks 5-8 of the semester.

4.12 Data Management

4.13.1 Coding

Prior to data collection, a coding manual was developed. The manual included codes for missing data, labels for variables and scale measures. A data management plan was also developed and kept on the QUT server as part of QUT data management policy. A copy of the Data Management Plan is attached as Appendix N.

4.12.2 Data cleaning and checking

Both complete and incomplete data were combined into one data set in an excel file. This file was then exported into an IBM SPSS statistics (Version 23) file for analysis. Data in the SPSS file were cleaned by checking line-by-line for completeness and through comparing to the original Excel file. Responses were further checked for accuracy through checking 20% of entries by an independent person.

Data were also screened for completeness and irregularities through frequency checks for outliers and checking the ranges of item responses with the coding manual. After checking and cleaning the data, some items were re-coded for analysis. Two items within the EBP Beliefs scale (Melnyk et al., 2008), were negatively worded and therefore had to be recoded (Item 11: “I believe that EBP takes too much time” and item 13: “I believe EBP is difficult”).

The questions pertaining to EBP knowledge were calculated to provide a sum of correct scores. This score could range from 0 (no answers correct) to 10 if all questions were correct. The score was used as a scale for further analysis. For the variables of EBP beliefs, EBP self-efficacy, EBP outcome expectancy, EBP use, Sources of EBP self-efficacy, EBP knowledge and Intention to use EBP, mean and standard deviation scores were calculated through computing the items for each scale into one single variable.

4.12.3 Missing data

Missing data can have a significant effect on prediction models through bias (Vergouwe, Royston, Moons, & Altman, 2010) and weakens the power of the study (Bouwmeester et al., 2012). Suggestions for handling missing data include multiple imputation or imputation of the mean, particularly if the data is related to participant characteristics (Bouwmeester et al., 2012; Vergouwe et al., 2010). Missing data was analysed for each episode of data collection using the maximisation expectation analysis in SPSS. Data found to be missing completely at random (MCAR) were imputed using individual data means or the mean from the representative group (e.g. all males or all females) (Tabachnick & Fidell, 1996). Procedures for analysing missing data are explained in more detail in section 5.2.1.

4.13 Data analysis

4.13.1 Descriptive analysis

Data were analysed using IBM SPSS Statistics (Version 23) and IBM AMOS Graphics (Version 23). Continuous data were checked for outliers and normality through histograms and frequency tables. Descriptive analysis using frequencies and percentages was undertaken for summarising the sample characteristics. Analysis of standard residuals was also undertaken to identify outliers. Likert scale data can often be non-normally distributed therefore the standard guide of skewness below 2 and Kurtosis below 7 was used to determine the need for any data transformation (Curran et al., 1996; Schreiber, 2008).

4.13.2 Bivariate analysis

Bivariate correlations among the variables of interest were conducted using Kendall's Tau to identify the strength and direction of association between the independent variables (Tabachnick & Fidell, 1996) and the dependent variable of Intetnion to use EBP. Kendall's Tau is proposed to be more amenable to nonlinear data and samples with risk of outliers (Newson, 2002), such as is common with Likert scale data. Due to the potential variation of distribution, it was determined to be a more appropriate choice. Only the significantly associated variables were included in the model. The correlation matrix was also examined for significant correlations between independant varibles and the variable of Intetnion to use EBP prior to deveopliment of the second prediction model. Again, only the significantly correlated variables were included in the second model.

Multi-collinearity can increase the risk of Type II error (Grewal, Cote, & Baumgartner, 2004) therefore as well as confirming inclusion of significantly correlated variables for the model, the correlation matrix was also carefully examined for any presence of multicollinearity. Lei and Wu (2007) suggest multicollinearity can be determined if variables are highly correlated (above 0.85). Grewal et al. (2002) also suggest multicollinearity can be a problem with correlations above 0.80. Any correlations found in the correlation matrix to be above these levels may potentially be removed from the analysis. Level of significance was set at $p<0.05$.

4.14 Model development procedures

Structural equation modelling was used to test two theory-based models to identify the degree to which the model was supported by the collected data (Schumaker & Lomax, 2004). Testing the hypothesised model enabled identification of significant and nonsignificant factors, which were then examined further in subsequent modelling to test the second hypothesis of factors influencing current use of EBP.

The data were checked for normality, independence and homoscedasticity prior to developing the model. SEM using Path analysis was conducted to identify the direction and strength of relationships between variables. Multiple regression analyses were undertaken during the path analysis using IBM AMOS graphics (Version 23) to determine the path coefficients. Direct and indirect effects of the variables were determined by analysing the beta weights of the regression analysis.

Model fit was determined by analysing model fit indices. Recommended indices for reporting model fit include the Chi-Square statistic, (with degrees of freedom and significance level) and other absolute fit indices, which represent how well the specified model fits the data (Lei & Wu, 2007; Hooper, Coughlan, & Mullen, 2008). These include Goodness-of-Fit index (GFI), Adjusted Goodness-of-Fit index (AGFI), Standardised Root Mean Square Residual (SRMR) and Root Mean Square

Error of Approximation (RMSEA). Incremental fit indices represent how much better the data fit compared to a baseline non-correlated model and include the Normed Fit Index (NFI) and Comparative Fit Index (CFI) (Lei & Wu, 2007). Parsimony of the model can be determined by examining the Parsimonious Normed Fit Index and/or Akaike Information Criteria (AIC). Parsimony indices should be analysed with other goodness-of-fit indices due to lack of specific criteria (Hooper et al., 2008).

4.15 Ethical Approval

This study was classified as low or negligible risk for human research and an ethics application was submitted to QUT Human Research Ethics Committee (HREC) and approved prior to data collection. The research adhered to QUT code of conduct for research and QUT responsible research framework that is supported by the Australian Code for the Responsible Conduct of Research (National Health and Medical Research Council, 2007). Participants were assured of anonymity as no identifying data was collected on the survey. Participants were also reminded that participation was voluntary and that they could withdraw from the research at any time without penalty. Completion of the survey was indication of consent. A copy of the QUT HREC approval is attached as Appendix O and the Participant Information Form is attached as Appendix P.

4.16 Summary of Chapter

This chapter has outlined the methods that were followed for Stage 2 of the research study. An explanation of the variables to be included in the prediction models was provided as well as the methods for data analysis. The following chapter will present the results of the multivariate prediction model development and validation.

Chapter 5: Results for Stage 2

5.1 Introduction

This chapter presents the results of Stage 2 of this research, specifically development and testing of two multivariate theory-based prediction models to accept or reject the hypotheses stated in Chapter 1. The first aim of the data analysis was to identify factors influencing undergraduate health student's intention to use EBP in their practice after graduation. A second prediction model was also developed and tested to identify factors influencing undergraduate student's current use of EBP. To test the fit of the theory-based hypothesised models, data from a cohort of first and/or second year undergraduate health students from disciplines of nursing and paramedicine were analysed. To test the validity of each model a second episode of data were collected from undergraduate students in the same two disciplines but from third or final year academic level. Testing a prediction model with new data other than the data used for determining the fit of the model development is defined as external validation and is seen as the most rigorous method for predictive modelling studies (Bouwmeester et al., 2012). According to Moons et al., (2015) models developed and tested in this manner can be referred to as a Type 3 prediction models.

Details of the samples for both data collection episodes are presented in this section as well as details of the modelling processes. Throughout this chapter, the terms Episode 1 will refer to the first data collection process and Episode 2 will refer to the second round of data collection.

5.2 Sample characteristics

This section reports how missing data were handled and follows with an explanation of the sample characteristics from both episodes of data collection.

5.2.1 Missing data

5.2.1.1 Missing data for Episode 1

The first episode of data collection obtained 241 questionnaires from nursing and/or paramedicine students enrolled in the second year of their undergraduate degree. Fourteen (6%) of these respondents had accessed the survey but had not entered any responses to any questions and were subsequently removed from the data set. Furthermore, 65 cases with more than 50% data missing were also removed. After data cleaning, 162 cases remained for the analysis. Missing values analysis confirmed any other missing data was completely at random (Little's MCAR test: Chi-square = 5597.987, d*f* = 6119, p = 1.000). This allowed use of the Expectation Maximisation Analysis function in SPSS data to replace missing values.

5.2.1.2 Missing Data for Episode 2

Episode 2 data collection obtained 85 responses from third and/or final year nursing and paramedic students. After cleaning and checking the data, only 47 complete cases were available for use in the modelling process. The 47 cases were checked to see if any further individual data were missing. There were only 13 cells with missing data in the entire data set and all were within different Likert response scales. Missing values analysis determined the missing data to be completely random (Little's MCAR test: Chi-square = 0.00, d*f* = 816, p = 1.000). Due to the small amount of missing data, mean scores were able to be entered (Tabachnick & Fidell, 1996).

5.2.2 Episode 1 Sample characteristics

From the 162 complete data cases in Episode 1, there were 125 undergraduate nursing students and 37 undergraduate paramedic students. There were 16 (9.9%) students enrolled in a Nursing and Paramedicine double degree and two students were enrolled in other nursing double degree courses (Nursing and Public Health, Nursing and Psychology). Data for age were not normally distributed with median age of 24yrs (IQR 9) with the minimum age being 18years and maximum age 57years (Refer Table 5-1).

Although currently enrolled in an undergraduate degree, a large proportion of the students (65.4%, n=106) had prior degrees in various health and non-health related fields (e.g. aviation, religious studies). For 55 (33.9%) students this was not their first Bachelor degree qualification (31.4%) and postgraduate qualifications for six students (3.7%), ranged from Graduate Diploma to Masters level qualification in health and non-health fields (e.g. business, theology).

Only 32 (19.8%) students had completed an EBP course during their degree however, 55 (34%) students reported having completed a research-based subject at some time (e.g. epidemiology, introductory statistics or general research methods). Just over a quarter of the sample reported having previous experience with EBP which was specified predominantly as work experience in a nursing field or having had exposure to EBP during clinical placements. Approximately 24% (n=39) of students were enrolled in the second year of their degree but were identified as being given advanced standing, course credit due to prior vocational based qualifications. This meant it was technically their first year of studying within the university environment. Further sample characteristics are presented in Table 5-1.

5.2.3 Episode 2 sample characteristics

For Episode 2, 48 complete cases were available for use (55%). The data for age were again not normally distributed, with the Episode 2 sample median age being slightly younger, at 23 years (IQR = 9; min =19yrs; max =50yrs). This sample comprised 16 nursing students, 22 Paramedicine students and 9 students who were enrolled in a nursing and paramedic double degree. Exactly half of the sample had prior formal qualifications ranging from certificates in health and non-health related courses (e.g. business administration, information technology) to Bachelor degrees in science, health or law disciplines. None of this sample reported having postgraduate qualifications.

5.2.4 Comparison of Episode 1 and Episode 2 samples

Despite having had more time in clinical placements than Episode 1 (as they were further along in their degree), just over 27% (n= 13) of Episode 2 respondents reported having prior EBP experience, through current nursing employment or previous training in phlebotomy, nursing, or laboratory work. A greater percent of students in Episode 2 (68.6%, n=33) reported completing an EBP unit compared to only 32 responses (19.8%) from Episode 1. The Chi-square test of significance identified a significant difference between the two groups for this characteristic (χ^2 =

78.64, p <0.000). This was to be expected however, as at the time of the survey the EBP unit for both disciplines was offered in the second year of the undergraduate degree course, therefore the Episode 2 sample should have all completed an EBP unit; despite this, five students in Episode 2 reported not completing a prior EBP unit. Full characteristics of Episode 1 and 2 samples are displayed in Table 5-1.

A statistically significant difference was found between the two episodes of data collection, for field of study (χ^2=27.34, p <0.000), however as the aim of the prediction model was to test for undergraduate health students generically, the entire sample was used for the model, therefore the significant difference was not a limitation to being included in the model.

5.2.5 Comparison of scale scores between groups

The mean scores for the independent and dependent variables for each episode of data collection were compared. Independent sample *t*-tests identified significant differences for subscale 3 of EBP self-efficacy (Implementing the evidence) and for all 5 subscales of the sources of EBP self-efficacy. Students in the second episode of data collection (3rd or final year) recorded significantly lower scores for self-efficacy in implementing evidence (Mean score = 69.25, SD = 20.44) than the students in the first episode of data collection (Mean score = 81.98, SD = 25.18), (*t* (208) = - 3.171, p = 0.002). Higher mean scores which indicated greater amounts of all sources of EBP self-efficacy, were experienced by the 3rd or final year students (Mean score = 77.85, SD =11.54) than for the second year or below students (Mean score = 56.81, SD = 12.78), (t (208) = 10.237, p <0.000). Mean scores for scales and subscales are reported in Table 5-2.

Table 5-1

Sample characteristics of Episode 1 and 2 data collection

Characteristic	Episode (n=162)	Episode 2 (n=48)	Chi-square (sig)
Age (median, IQR)	24yrs (9)	23yrs (5)	
Field of study (n, %)			27.34
Nursing	123 (75.9)	17 (34.0)	(p <0.000)
Paramedicine	21 (12.9)	22(46.8)	
Nursing and Paramedicine	16 (9.9)	9 (19.1)	
Other nursing double degree	2 (1.2)		
Academic year level (N)			
2nd year	123 (75.9)		
2nd year graduate entry	39 (24.1)		
3rd or final year		48	
Other formal education (n, %)			
No	56 (34.5)	24 (50.0)	3.74
Yes*	106 (65.4)	24(50.0)	(p = 0.063)
Other certificate	19 (11.7)		
Other diploma	48 (29.6)		
Other Bachelor	55 (33.9)		
Postgraduate	6 (3.7)		
other			
Prior EBP experience (n, %)			
No	120 (73.6)	35 (72.9)	0.922
Yes	42 (25.3)	13 (27.1)	(p = 0.575)
Prior EBP unit completed (n, %)			
No	130 (80.2)	5 (10.4)	78.64
Yes	32 (19.8)	33 (68.6)	(p <0.000)
Prior research unit completed (n, %)			
No	107 (66.0)	29 (60.4)	0.515
Yes	55 (33.9)	19 (33.3)	(p = 0.495)
General research methods	38 (23.4)	8 (16.6)	
Health statistics	9 (5.6)	5 (10.4)	
Epidemiology	2 (1.2)	2 (4.1)	
Other	6 (3.7)	4 (8.3)	

*some students may have more than one other formal qualification

Table 5-2

Comparison of mean scores for independent and dependent variables between two data collection episodes

Variable	1st episode (n=162) Mean (SD)	Range of possible scores	2nd episode (n=48) Mean (SD)	t-test (equal variances assumed)
EBP beliefs total	43.17 (7.93)	0-64	41.81 (7.73)	t (208) = -1.045, p =0.297
EBP Self-efficacy total	175.4 (43.66)	0-280	172.52 (39.49)	t (208) = -0.410, p = 0.682
EBP self-efficacy subscale 1: identifying the problem	30.98 (6.962)	0-50	32.96 (6.69)	t (208) =1.745, p = 0.82
EBP self-efficacy subscale 2: Searching for evidence	62.44 (15.38)	0-90	62.77 (15.23)	t (208) =0.131, p =0.896
EBP self-efficacy subscale 3: implementing the evidence	81.98 (25.48)	0-140	69.25 (20.44)	t (208) = - 3.171, p = 0.002*
EBP outcome expectancy total	56.91 (14.13)	0-80	57.00 (13.88)	t (208) = 0.41, p = 0.968
EBP knowledge total	5.99 (1.67)	0-10	5.6 (1.54)	t (208) = -1.429, p = 0.155
Current EBP use total	32.08 (13.82)	8-56	31.02 (11.01)	t (208) = -0.487, p = 0.627
Sources of EBP self-efficacy total	56.81 (12.78)	0-88	77.85 (11.54)	t (208) = 10.237, p <0.000*

Table 5-2 (cont.) Comparison of mean scores for independent and dependent variables between two data collection episodes

Variable	1st episode (n=162) Mean (SD)	Range of possible scores	2nd episode (n=48) Mean (SD)	t-test (equal variances assumed)
Sources of EBP self-efficacy subscale 1: Mastery	11.45 (4.36)	0-20	16.06 (4.15)	t (208) = 6.500, p <0.000*
Sources of EBP self-efficacy subscale 2: Vicarious learning experiences	10.74 (3.42)	0-16	15.64 (3.34)	t (208) = 8.772, p < 0.000*
Sources of EBP self-efficacy subscale 3: Vicarious learning peers	10.75 (2.66)	0-16	14.52 (2.63)	t (208) =8.185, p < 0.000*
Sources of EBP self-efficacy subscale 4: verbal persuasion	11.65 (2.61)	0-16	15.75 (2.25)	t (208) = 9.832, p = 0.000*
Sources of EBP self-efficacy subscale 5: physiological symptoms	12.00 (3.94)	0-20	16.50 (3.89)	t (208) = 6.959, p < 0.000*
EBP intention total	17.64 (3.18)	4-24	16.96 (3.35)	t (208) = -1.279. p = 0.202

*significant at $p < 0.05$

5.3 Bivariate correlations between variables considered for inclusion in the hypothesised model

Significant bivariate correlations with the outcome variable of Intention to use EBP were identified for EBP self-efficacy, sources of EBP self-efficacy, EBP beliefs, EBP outcome expectancy and EBP use (Refer table 5-3). Accordingly, these were the only variables were entered into the prediction model. The variables of age and other formal qualification were found to be singificantly correlated to each other but not to the outcome variable therfore they were not included in the model. There were no correlations above 0.80 therefore multicollinearity was not present (Grewal et al., 2002). Although data for age were not normally distributed, it was still within acceptable range for entering into the correlation matrix. Consequently, after careful examination of the correlation matrix, five variables significantly correlated to the outcome of interest were included as predictor (independent) variables.

Table 5-3

Bivariate correlations (Kendall's Tau) between dependant (outcome) and independent (predictor) variable

	1	2	3	4	5	6	7	8	9	10	11
1. Age		0.339**	0.132*	-0.030	0.031	-0.040	-0.099	-0.078	0.004	0.073	-0.041
2. Other formal qualification			0.269**	-0.054	0.070	-0.012	-0.044	-0.077	0.020	0.066	-0.089
3. Other EBP experience				-0.086	0.105	-0.042	0.004	0.048	0.044	0.085	-0.008
4. Other research subject/unit					0.019	0.151	0.066	0.101	-0.009	-0.109	-0.044
5. EBP Beliefs						0.344	0.332*	0.245*	0.376**	0.005	0.313**
6. EBP self-efficacy							0.272*	0.533*	0.338**	-0.045	0.245**
7. Sources of EBP self-efficacy								0.228*	0.458**	0.067	0.204**
8. EBP outcome expectancy									0.215**	-0.098	.211**
9. EBP use										0.039	0.215**
10.EBP knowledge											0.032
11.EBP intention											

**Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)

5.4 Model of factors influencing health students’ intention to use EBP following graduation

5.4.1 Hypothesised model

The hypothesised theory-based model, updated to include the five variables significantly correlated with intention to use EBP, is represented in Figure 5-1. Each rectangle represents an observed variable and the specified model has arrows indicating direction of the influential factors, determined from results of the correlation matrix. Error terms were added to each variable to account for any measurement error (Schumacher & Lomax, 2012).

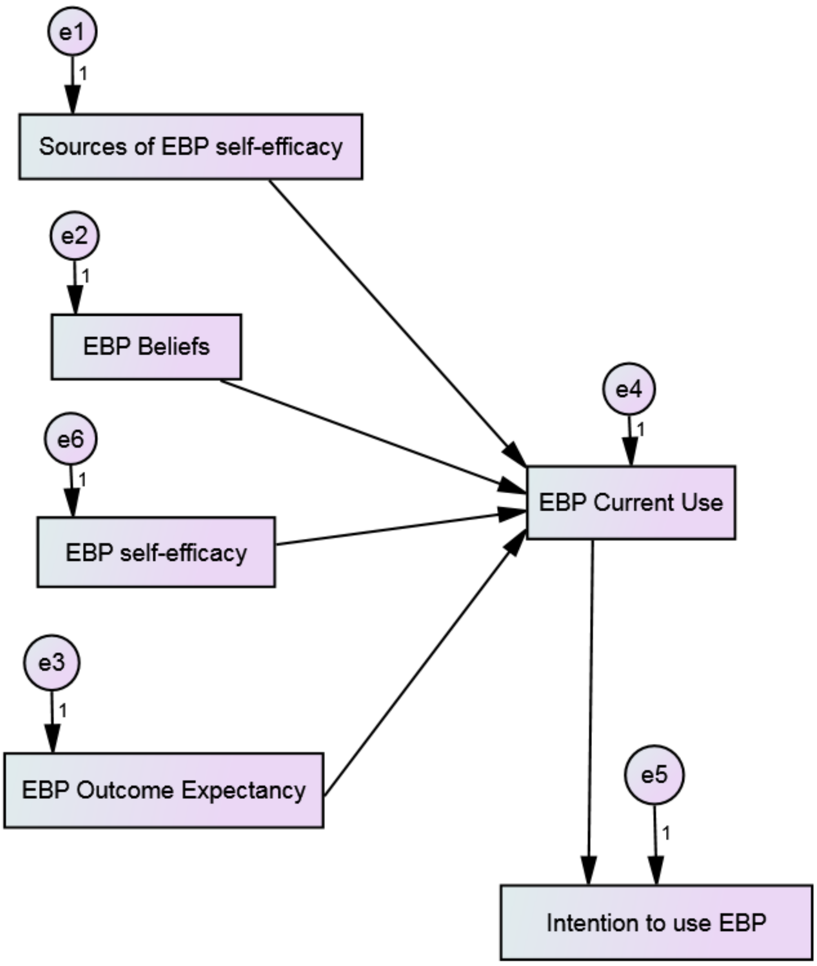


Figure 5-1. Hypothesised model of factors influencing undergraduate health students’ intention to use EBP.

5.4.2 Model Fit

Prior to fitting the model, the assumptions of linearity and normality were found to be satisfactory. Collinearity statistics indicated there was no violation of this assumption and scatter plots of observed and predicted residuals confirmed homoscedasticity was not violated. The variables entered into the model were those identified in the correlation matrix as correlated to the outcome of Intention to use EBP as found in the correlation matrix. The initial fit of the model with Episode 1 data, to identify factors influencing undergraduate health students' intention to use of EBP, is presented as Figure 5-2. Paths are depicted as solid arrows and standardised estimates are displayed next to each path.

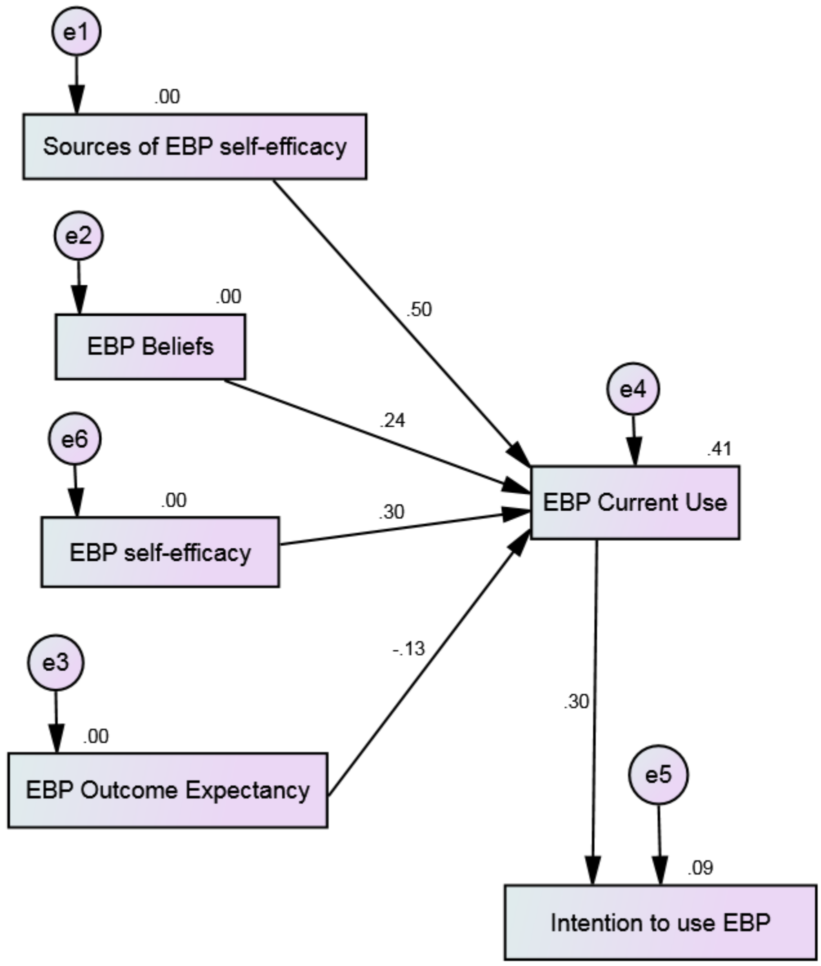


Figure 5-2. Results of hypothesised model fit for model of factors influencing undergraduate health students' intention to use EBP using data from Episode 1.

5.4.3 Model evaluation

In order to determine model fit, the model fit indices were examined. Using Maximum Likelihood Analysis, the indices for the model were indicative of a very poor fit ($\chi^2 = 265.839$, d*f* = 10, $p < 0.001$). Full model fit results, with examples of recommended indices for comparison, are reported in Table 5-4. The GFI of 0.617 was much lower than desired and the adjusted GFI (AGFI) was 0.195, significantly below the desired value of >0.95 (Hooper et al., 2008). The SRMR of 0.3362 was vastly higher than the desired value of <0.08 (Hooper et al., 2008), indicating a significant difference between the standardized observed and predicted correlations (Hu & Bentler, 1995). It was determined from the indices that the model required trimming.

Table 5-4

SEM fit indices for hypothesised model of factors influencing undergraduate health students' intention to use EBP using data from Episode 1

<table>
<tr><th>Explanation</th><th>Index</th><th>Result</th><th>Recommended value for good fit*</th></tr>
<tr><td rowspan="4">Absolute fit indices: reflect the degree to which the proposed model fits the data; can be sensitive to sample size</td><td>Chi-Square test</td><td>χ^2 = 265.839,
df = 10,
$p < 0.001$
χ^2/ df = 26.5839</td><td>Non significant result preferred
Ratio of χ^2 to df ≤ 2 or 3</td></tr>
<tr><td>GFI</td><td>0.617</td><td>>0.90</td></tr>
<tr><td>AGFI</td><td>0.195</td><td>>0.95</td></tr>
<tr><td>SRMR</td><td>0.336</td><td><0.08</td></tr>
<tr><td>Residual index: difference between a sample covariance matrix and hypothesised covariance model</td><td>RMSEA</td><td>0.399</td><td><0.05
(>0.10 = poor fit)</td></tr>
<tr><td>RMSEA Confidence Intervals</td><td>LO 90, HI 90</td><td>0.358, 0.441</td><td>0.00 – 0.08 (90% CI)</td></tr>
<tr><td>Closeness of fit (RMSEA)</td><td>PCLOSE</td><td>0.000</td><td>>0.5</td></tr>
<tr><td rowspan="2">Incremental (comparative/relative) fit indices: reflect model fit compared to a null model</td><td>NFI</td><td>0.333</td><td>>0.095</td></tr>
<tr><td>CFI</td><td>0.333</td><td>>0.90</td></tr>
<tr><td rowspan="2">Parsimonious fit indices: fit indices adjusted for parsimony</td><td>PGFI</td><td>0.294</td><td>No set level; approx. 0.50 if GFI >0.90</td></tr>
<tr><td>AIC</td><td>287.839</td><td>Closer to zero compared to other model = better fit</td></tr>
</table>

*Sources: Byrne, 2010; Hooper et al., 2008; Hu & Bentler, 1999; Schreiber, 2008

Note: GFI = Goodness of Fit; AGDI = Adjusted goodness of Fit; SRMR = Standardised Root Mean Square Residual; RMSEA = Root Mean Standard Error of Approximation; NFI = Normative Fit Index; CFI = Comparative Fit Index; PGFI = Parsimony goodness of Fit Index; AIC = Akaike's Information Criterion.

5.4.4 Model trimming

The output from the modelling analysis program identified changes that needed to be made to the hypothesised model to improve fit. More specifically, paths needed to be added to the model to depict direct effect of EBP self-efficacy to EBP Beliefs and another path from EBP Beliefs directly to EBP intention. Other paths suggested for inclusion were from sources of EBP self-efficacy to EBP outcome expectancy and from EBP sources of self-efficacy to EBP self-efficacy. Some paths were removed according to the output report, for example no direct relationship was identified between EBP current use and Intention to use EBP. After making these modifications, data from Episode 1 were fit to the trimmed model using Maximum Likelihood Analysis. Figure 5-3 displays the trimmed model.

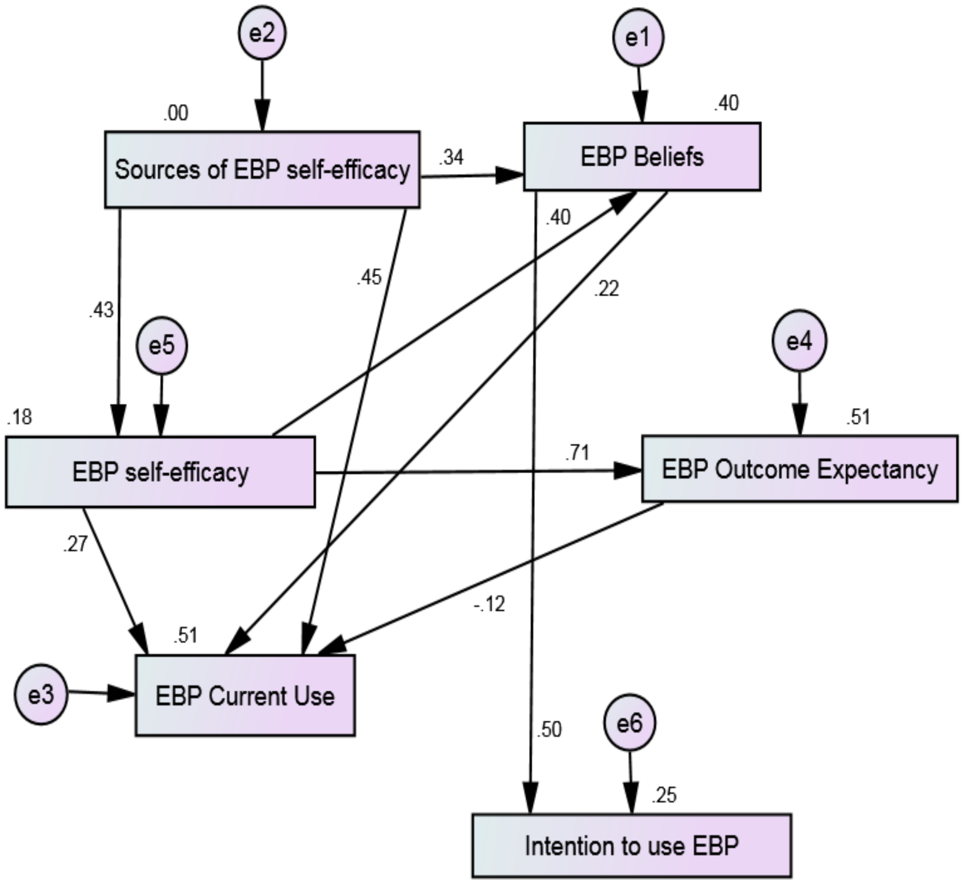


Figure 5-3. Results of trimmed model fit for model of factors influencing undergraduate health students' intention to use EBP using data from Episode 1.

Results of the analysis identified a good fit of the data to the model (χ^2 = 9.04, d*f* = 6, p =0.171). The GFI, RMSEA and RMR were all within 'good fit' parameters. Other model fit indices for the trimmed model are seen in Table 5-5. The overall model represented 25% of variation for Intention to use EBP (R^2 = 0.25).

Table 5-5

SEM fit indices for trimmed model fit of factors influencing undergraduate health students' intention to use EBP using data from Episode 1

Explanation	**Index**	**Result**	**Recommended value for good fit***
Absolute fit indices: **reflect the degree to which the proposed model fits the data; can be sensitive to sample size**	Chi-Square test	χ^2 = 9.04, d*f* = 6, p = 0.171, χ^2/ **d*f*** = 1.506	**Non significant result preferred** **Ratio of χ^2 to d*f* ≤ 2 or 3**
	GFI	**0.982**	>0.90
	AGFI	**0.936**	>0.95
	SRMR	**0.0451**	<0.08
Residual index: **difference between a sample covariance matrix and hypothesised covariance model**	RMSEA	**0.046**	<0.05 (>0.10 = poor fit)
RMSEA Confidence Intervals	LO 90, HI 90	**0.000, 0.124**	0.00 – 0.08 (90% CI)
Closeness of fit (RMSEA)	PCLOSE	**0.338**	>0.5
Incremental (comparative/relative) fit indices: **reflect model fit compared to a null model**	NFI	**0.977**	>0.095
	CFI	**0.992**	>0.90
Parsimonious fit indices: **fit indices adjusted for parsimony**	PGFI	**0.291**	No set level; approx 0.50 if GFI >0.90
	AIC	39.040	Closer to zero compared to other model = better fit

*Sources: Byrne, 2010; Hooper et al., 2008; Hu & Bentler, 1999; Schreiber, 2008

Note: GFI = Goodness of Fit; AGDI = Adjusted goodness of Fit; SRMR = Standardised Root Mean Square Residual; RMSEA = Root Mean Standard Error of Approximation; NFI = Normative Fit Index; CFI = Comparative Fit Index; PGFI = Parsimony goodness of Fit Index; AIC = Akaike's Information Criterion.

5.4.5 Model findings

Findings from the trimmed model identified EBP beliefs as the only factor to have a direct and significantly positive influence on the outcome variable of Intention to use EBP ($\beta = 0.501$; $p < 0.001$). EBP self-efficacy had significant influence on both EBP outcome expectancy ($\beta = 0.712$; $p < 0.001$) and EBP beliefs ($\beta = 0.405$; $P < 0.001$). Sources of EBP self-efficacy had significant, direct influence on EBP self-efficacy ($\beta = 0.426$; $p < 0.001$), EBP Beliefs ($\beta = 0.344$; $p < 0.001$) and EBP current use ($\beta = 0.450$; $p < 0.002$). Other relationships significant at different levels were between EBP beliefs and EBP Current Use ($\beta = 0.221$; $p = 0.002$) and EBP self-efficacy and current EBP use ($\beta = 0.269$; $p = 0.002$). A non-significant, negative path from outcome expectancy toward EBP use was identified ($\beta = -0.115$; $p = 0.141$). The trimmed, good fitting model was subsequently validated using data collected from Episode 2.

5.4.6 Model validation

Data collected in Episode 2 were used to test the modified model of factors influencing undergraduate health students' intention to use EBP after graduation. Testing a prediction model with a separate sample is a form of external validation for SEM (Bouwmeester et al., 2012). Episode 2 data were collected from nursing and paramedicine students in their third and/or final year of their undergraduate degree. There was a much lower sample size for Episode 2 ($n = 48$) therefore the model was tested using Maximum Likelihood analysis with bootstrapping techniques within the AMOS software. Bootstrapping is appropriate for simple SEM models with smaller sample sizes (Nevitt & Hancock, 2001; Schermelleh-Engel, Moosbrugger, & Müller, 2003). Bootstrapping resamples the current sample according to the number of iterations entered into the analysis; for this model, 200 iterations were used.

The model fit for Episode 2 data is displayed in figure 5-4. The overall model fit was determined as poorer than the first, trimmed model (Figure 5-3). Fit indices for the validated model were: $\chi^2 = 24.44$, d*f* = 6, $p < 0.001$, GFI = 0.870, AGFI = 0.546, RMSEA = 0.256 and SRMR = 0.147. Full model indices with recommended values for good fit are reported in table 5-6.

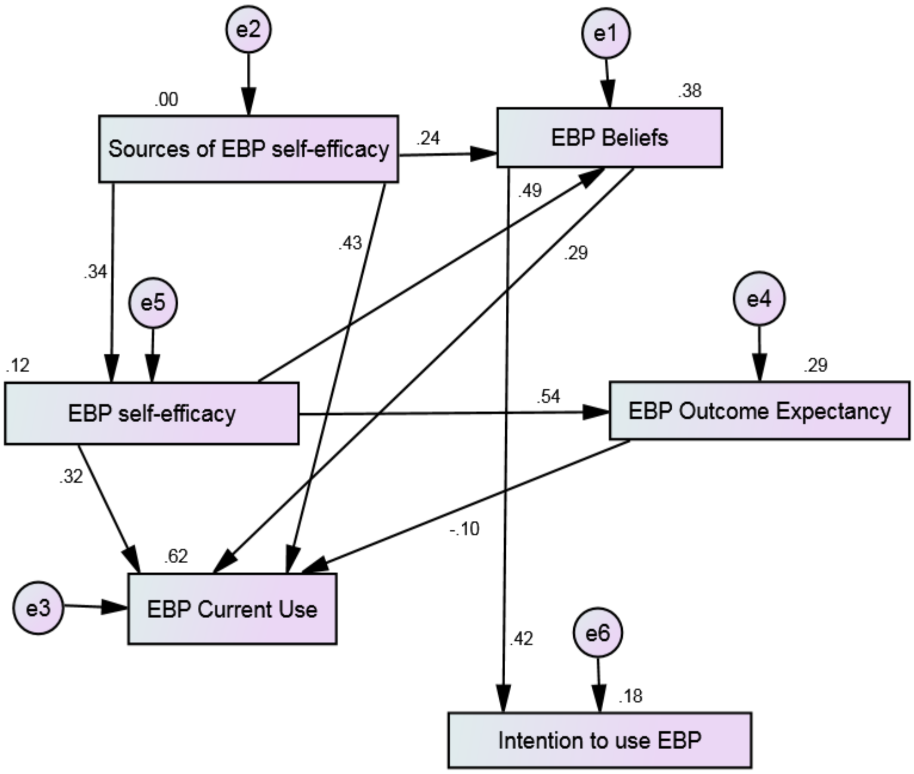


Figure 5-4. Results of validated trimmed model fit for model of factors influencing undergraduate health students' intention to use EBP using data from Episode 2**.**

Table 5-6

SEM fit indices for validated trimmed model fit of factors influencing undergraduate health students' intention to use EBP using data from Episode 2

Explanation	Index	Result	Recommended value for good fit*
Absolute fit indices: **reflect the degree to which the proposed model fits the data; can be sensitive to sample size**	Chi-Square test	χ^2 = 24.44, d*f* = 6, p < 0.001 χ^2/ **d*f*** = 4.073	**Non significant result preferred** **Ratio of χ^2 to d*f* ≤ 2 or 3**
	GFI	0.870	>0.90
	AGFI	0.546	>0.95
	SRMR	0.147	<0.08
Residual index: **difference between a sample covariance matrix and hypothesised covariance model**	RMSEA	0.256	<0.05 (>0.10 = poor fit)
RMSEA Confidence Intervals	LO 90, HI 90	**0.155, 0.365**	0.00 – 0.08 (90% CI)
Closeness of fit (RMSEA)	PCLOSE	**0.001**	>0.5
Incremental (comparative/relative) fit indices: **reflect model fit compared to a null model**	NFI	0.799	>0.095
	CFI	0.827	>0.90
Parsimonious fit indices: **fit indices adjusted for parsimony**	PGFI	0.249	No set level; approx 0.50 if GFI >0.90
	AIC	54.442	Closer to zero compared to other model = better fit

*Sources: Byrne, 2010; Hooper et al., 2008; Hu & Bentler, 1999; Schreiber, 2008

Note: GFI = Goodness of Fit; AGDI = Adjusted goodness of Fit; SRMR = Standardised Root Mean Square Residual; RMSEA = Root Mean Standard Error of Approximation; NFI = Normative Fit Index; CFI = Comparative Fit Index; PGFI = Parsimony goodness of Fit Index; AIC = Akaike's Information Criterion.

5.4.7 Findings from validated model

Despite the poorer fit to the model, the overall model still accounted for 18 % of variance for students' Intention to use EBP ($R^2 = 0.18$). A direct and significant relationship was again found between EBP beliefs and Intention to use EBP ($\beta = 0.419$; $p = 0.002$). Significant paths were identified from Sources of EBP self-efficacy to EBP beliefs ($\beta = 0.240$; $p = 0.049$), EBP self-efficacy toward EBP Beliefs ($\beta = 0.492$; $p < 0.001$) and EBP self-efficacy and EBP outcome expectancy ($\beta = 0.537$; $p < 0.001$). Other significant relationships were found between EBP beliefs and EBP current use ($\beta = 0.294$; $p = 0.010$), Sources of EBP self-efficacy to EBP current use ($\beta = 0.426$; $p < 0.001$), Sources of EBP self-efficacy and EBP self-efficacy ($\beta = 0.342$; $p = 0.013$) and EBP self-efficacy and EBP current use ($\beta = 0.324$; $p = 0.009$). A non-significant path was again identified between EBP outcome expectancy and current EBP use ($\beta = -0.102$; $p = 0.319$).

Comparisons of significant and nonsignificant regression weights for the trimmed model, using sample 1 data and the validated model using sample 2 data are presented in Table 5-7. The comparison of regression weights from the trimmed model to the validated model identified significant paths common to both models, although some at different levels of significance as highlighted by the modelling software program. The subsequent modelling process examined factors influencing EBP current use in more detail.

Table 5-7

Comparison of standardised regression weights and model variance for trimmed and validated models of Intention to use EBP

Trimmed model (Episode 1 data; n = 162)					Validated model (Episode 2 data; n = 48)				
	Variable	**Standardised regression weight (β)**	**Level of sig**	**R^2**		**Variable**	**Standardised regression weight (β)**	**Level of sig**	**R^2**
Direct influence					**Direct influence**				
EBP beliefs	Intention to use EBP	0.501	<0.001		EBP beliefs	Intention to use EBP	0.419	0.002	
Indirect influence					**Indirect influence**				
Sources of EBP self-efficacy	EBP self-efficacy	0.426	< 0.001		Sources of EBP self-efficacy	EBP self-efficacy	0.342	0.013	
Sources of EBP self-efficacy	EBP beliefs	0.344	< 0.001		Sources of EBP self-efficacy	EBP beliefs	0.240	0.049	
EBP self-efficacy	EBP Outcome expectancy	0.712	< 0.001		EBP self-efficacy	EBP Outcome expectancy	0.537	<0.001	
EBP self-efficacy	EBP current use	0.269	0.002		EBP self-efficacy	EBP current use	0.324	0.009	
EBP self-efficacy	EBP beliefs	0.405	< 0.001		EBP self-efficacy	EBP beliefs	0.492	<0.001	
EBP beliefs	EBP current use	0.221	0.002		EBP beliefs	EBP current use	0.294	0.010	
EBP outcome expectancy	EBP current use	-0.115	0.141		EBP outcome expectancy	EBP use	-0.102	0.339	
Sources of EBP self-efficacy	EBP current use	0.450	< 0.001		Sources of EBP SE	EBP current use	0.426	<0.001	
Model variance				**0.25**					**0.18**

5.5 Factors influencing undergraduate health students current use of EBP

5.5.1 Hypothesised model

To test the second hypothesis relating to factors influencing undergraduate health students' current use of EBP, data from Episode 1 were entered into the hypothesised model with EBP current use as the outcome variable (Refer Figure 5-5). Variables significantly correlated to EBP current use were selected from the correlation matrix (Refer Table 5-3). These variables were EBP beliefs, EBP self-efficacy, Sources of EBP self-efficacy and EBP outcome expectancy. Error terms were applied to each variable. The analysis was conducted using Maximum Likelihood analysis. Previous checks for linearity, normality, multicollinearity and homoscedasticity detected no violations. Results of model fit for factors influencing undergraduate health students' current use of EBP, using data from Episode 1, are seen in Figure 5-5.

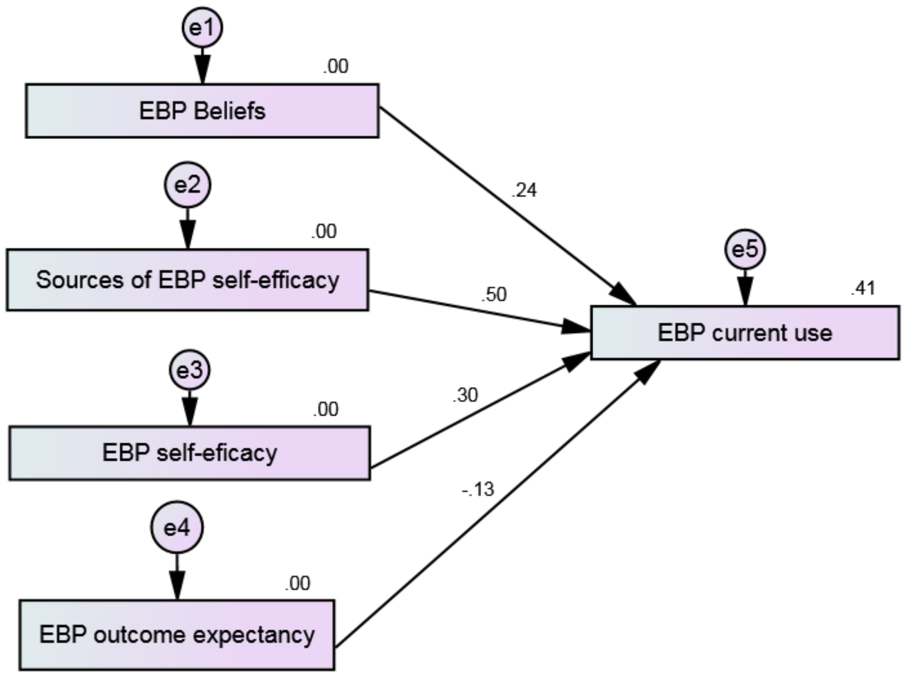


Figure 5-5. Results of hypothesised model fit for model of factors influencing undergraduate health students' current use of EBP using data from Episode 1**.**

5.5.2 Model fit

The hypothesised model was initially determined to be a poor fit for the data as determined by the model fit indices. The Chi-square test was significant ($\chi 2$ = 231.594, d*f* = 6, p <0.001), which in this instance is not preferred as it indicates a significant difference between the sample and the fitted covariance matrices (Hooper et al., 2008). Other absolute and incremental model fit indices were below recommended criteria for good fit. The RMSEA and standardised RMR were higher than desired (RMSEA = 0.116; SRMR = 0.3596). Full model fit indices are reported in Table 5-8.

Table 5-8

Model fit indices for hypothesised model of factors influencing undergraduate health students' current use of EBP using Episode 1 data

Explanation	Index	Result	Recommended value for good fit*
Absolute fit indices: **reflect the degree to which the proposed model fits the data; can be sensitive to sample size**	Chi-Square test	$\chi 2$ = 231.594, df = 6, p <0.001 χ^2/df = 38.599	**Non significant result preferred** **Ratio of χ^2 to df ≤ 2 or 3**
	GFI	0.616	>0.90
	AGFI	0.039	>0.95
	SRMR	0.3596	<0.08
Residual index: **difference between a sample covariance matrix and hypothesised covariance model**	RMSEA	0.483	<0.05 (>0.10 = poor fit)
RMSEA Confidence Intervals	LO 90, HI 90	**0.431, 0.538**	0.00 – 0.08 (90% CI)
Closeness of fit (RMSEA)	PCLOSE	**0.000**	>0.5
Incremental (comparative/relative) fit indices: **reflect model fit compared to a null model**	NFI	0.985	>0.095
	CFI	0.993	>0.90
Parsimonious fit indices: **fit indices adjusted for parsimony**	PGFI	0.246	No set level; approx 0.50 if GFI >0.90
	AIC	249.594	Closer to zero compared to other model = better fit

*Sources: Byrne. 2010; Hooper et al., 2008; Hu & Bentler, 1999; Schreiber, 2008

Note: GFI = Goodness of Fit; AGDI = Adjusted goodness of Fit; SRMR = Standardised Root Mean Square Residual; RMSEA = Root Mean Standard Error of Approximation; NFI = Normative Fit Index; CFI = Comparative Fit Index; PGFI = Parsimony goodness of Fit Index; AIC = Akaike's Information Criterion

5.5.3 Model evaluation and trimming

Despite the poor model fit, significant paths were identified (refer Figure 5-5) from EBP Beliefs to EBP current use ($\beta = 0.244$; $p < 0.001$), Sources of EBP self-efficacy toward EBP current use ($\beta = 0.496$; $p < 0.001$) and EBP self-efficacy to EBP current use ($\beta = 0.296$; $p < 0.001$). The modification indices from the model analysis output suggested the model had more interactions than hypothesized and again suggested including several parameter changes to improve model fit. Initially all recommended parameters were included in the model but the model was unable to be identified. Consequently, the model was trimmed and re-run using data from Episode 1. The final trimmed model with the outcome of EBP current use is seen in Figure 5-6.

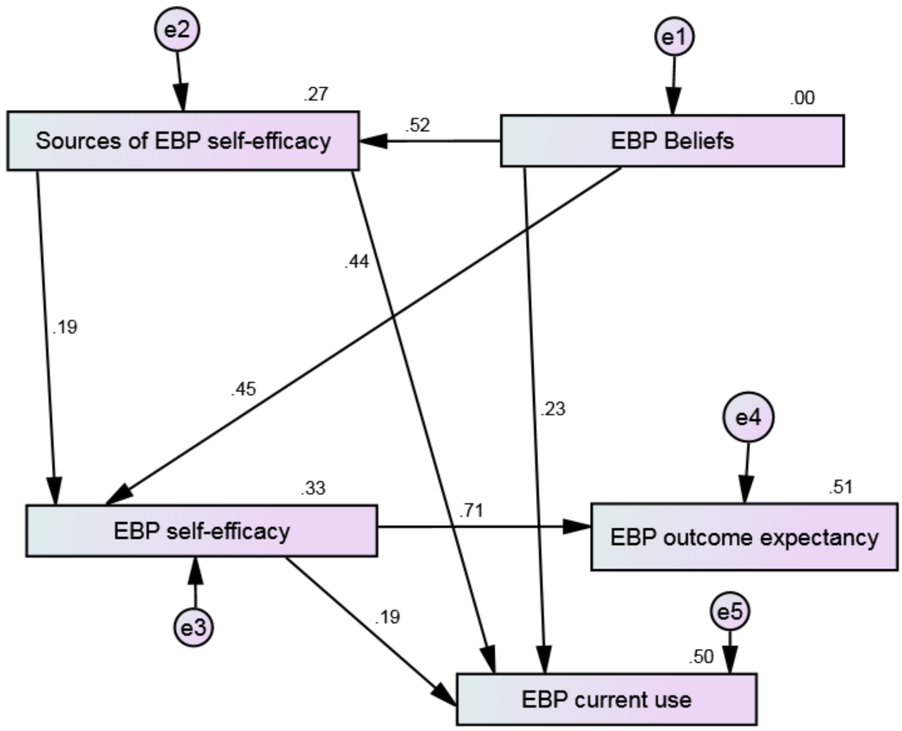


Figure 5-6. Results of trimmed model fit for model of factors influencing undergraduate health students' current EBP use using data from Episode 1.

5.5.4 Model findings

Model fit indices for the trimmed model identified a good fit to the data. The Goodness-of-fit (GFI) index was 0.987 and adjusted GFI 0.936. The non-significant chi-squared test (χ^2 = 5.275; d*f* = 3, p = 0.153) and other absolute and incremental fit indices supported a good model fit. Model fit indices for the trimmed model of factors influencing undergraduate health student's current use of EBP are reported in table 5-9.

The trimmed model identified three variables as direct, positive influences to students' current EBP use. Sources of self-efficacy (β = 0.438; p < 0.001), EBP beliefs (β = 0.0.228; p = 0.002) and EBP self-efficacy (β = 0.190; p = 0.005) all predicted students use of EBP during their degree. EBP self-efficacy was a direct positive influence on EBP outcome expectations (β = 0.712; p = 0.002), however similar to the first model for Intention to use EBP, there was no path from outcome expectancy to EBP current use. All other paths in the model were also significant, albeit indirect. EBP beliefs had large, direct effect on Sources of EBP self-efficacy (β = 0.516; p < 0.001), and on EBP self-efficacy (β = 0.452; p < 0.001). Sources of EBP self-efficacy had small but direct influence to EBP self-efficacy (β = 0.193; p = 0.010).

Overall the model with direct and indirect relationships between the variables explained 50 % of variance (R^2 = 0.50) in student's current use of EBP during their course. Data from the second episode of data collection were subsequently fit to validate the model.

Table 5-9

Model fit indices for trimmed model of factors influencing undergraduate health students' current use of EBP

Explanation	Index	Result	Recommended value for good fit*
Absolute fit indices: **reflect the degree to which the proposed model fits the data; can be sensitive to sample size**	Chi-Square test	χ^2 = 5.275; d*f* = 3, p = 0.153 **χ^2/d*f*** = 1.758	**Non significant result preferred** **Ratio of χ^2 to d*f* ≤ 2 or 3**
	GFI	0.987	>0.90
	AGFI	0.936	>0.95
	SRMR	0.0218	<0.08
Residual index: **difference between a sample covariance matrix and hypothesised covariance model**	RMSEA	0.069	<0.05 (>0.10 = poor fit)
RMSEA Confidence Intervals	LO 90, HI 90	**0.000, 0.163**	0.00 – 0.08 (90% CI)
Closeness of fit (RMSEA)	PCLOSE	**0.292**	>0.5
Incremental (comparative/relative) fit indices: **reflect model fit compared to a null model**	NFI	0.985	>0.095
	CFI	0.993	>0.90
Parsimonious fit indices: **fit indices adjusted for parsimony**	PGFI	0.197	No set level; approx 0.50 if GFI >0.90
	AIC	29.275	Closer to zero compared to other model = better fit

*Sources: Byrne, 2010; Hooper et al., 2008; Hu & Bentler, 1999; Schreiber, 2008

Note: GFI = Goodness of Fit; AGDI = Adjusted goodness of Fit; SRMR = Standardised Root Mean Square Residual; RMSEA = Root Mean Standard Error of Approximation; NFI = Normative Fit Index; CFI = Comparative Fit Index; PGFI = Parsimony goodness of Fit Index; AIC = Akaike's Information Criterion

5.5.5 Model validation

Data from Episode 2 were used to validate the multivariate model of factors influencing undergraduate health student's current use of EBP. The sample for Episode 2 comprised undergraduate nursing and paramedic students in their third and/or final year of their undergraduate degree. As mentioned previously, the sample size for Episode 2 (n = 48) was much lower than for the Episode 1 (n = 162) therefore bootstrapping techniques were used during the model testing and validation. Bootstrapping is appropriate for this model as it is a simple model (Nevitt & Hancock, 2001; Schermelleh-Engel et al., 2003). Two hundred (200) bootstrap samples were used to validate the model. The validated model with standardised regression weights is presented as Figure 5.7.

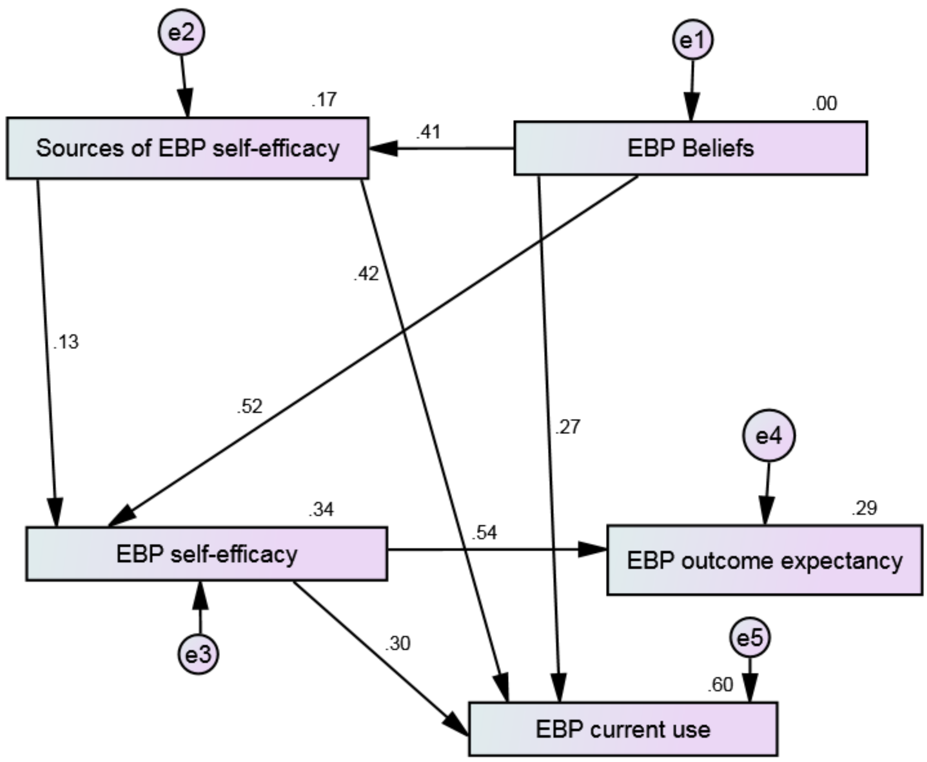


Figure 5-7. Results of validated trimmed model of factors influencing undergraduate health students' current use of EBP tested with data from Episode 2.

5.5.6 Findings from validated model

The tested model demonstrated a 'good enough' fit to the data. Absolute fit indices included: $\chi 2 = 7.321$, df = 3, $p = 0.062$; GFI = 0.945, AGFI = 0.727; SRMR = 0.079, RMSEA = 0.175. Incremental fit indices were NFI = 0.923, CFI = 0.949 and parsimony criteria were unremarkable. Table 5-10 displays fit indices with recommended criteria for assessing good fit. Despite the poorer fit, the direct and indirect relationships within the model explained 60% of the variance for undergraduate health students' current use of EBP.

For the validated model, current EBP use was significantly influenced by Sources of EBP self-efficacy ($\beta = 0.416$; $p < 0.001$), EBP self-efficacy ($\beta = 0.296$; $p = 0.009$) and EBP beliefs ($\beta = 0.27$, $p = 0.021$). Indirect but significant paths were found from EBP beliefs to Sources of EBP self-efficacy ($\beta = 0.408$; $p = 0.002$), EBP beliefs to EB self-efficacy ($\beta = 0.521$, $p < 0.001$) and EBP self-efficacy to EBP outcome expectancy ($\beta = 0.537$, $p <0.001$). A non-significant path was identified from Sources of EBP self-efficacy to EBP self-efficacy ($\beta = 0.129$; $p = 0.319$) which was different to results of the first episode of data collection. A comparison of the regression weights for both episodes of data collection is seen in Table 5-11.

Table 5-10

Model fit indices for validated trimmed model of factors influencing undergraduate health students' current use of EBP

Explanation	Index	Result	Recommended value for good fit*
Absolute fit indices: **reflect the degree to which the proposed model fits the data; can be sensitive to sample size**	Chi-Square test	χ^2 = 7.321, d*f* = 3, p = 0.062 **χ^2/df** = 2.440	**Non significant result preferred** **Ratio of χ^2 to d*f* ≤ 2 or 3**
	GFI	0.945	>0.90
	AGFI	0.727	>0.95
	SRMR	0.079	<0.08
Residual index: **difference between a sample covariance matrix and hypothesised covariance model**	RMSEA	0.175	<0.05 (>0.10 = poor fit)
RMSEA Confidence Intervals	LO 90, HI 90	**0.000, 0.341**	0.00 – 0.08 (90% CI)
Closeness of fit (RMSEA)	PCLOSE	**0.087**	>0.5
Incremental (comparative/relative) fit indices: **reflect model fit compared to a null model**	NFI	0.923	>0.095
	CFI	0.949	>0.90
Parsimonious fit indices: **fit indices adjusted for parsimony**	PGFI	0.189	No set level; approx 0.50 if GFI >0.90
	AIC	31.321	Closer to zero compared to other model = better fit

*Sources: Byrne, 2010; Hooper et al., 2008; Hu & Bentler, 1999; Schreiber, 2008

Note: GFI = Goodness of Fit; AGDI = Adjusted goodness of Fit; SRMR = Standardised Root Mean Square Residual; RMSEA = Root Mean Standard Error of Approximation; NFI = Normative Fit Index; CFI = Comparative Fit Index; PGFI = Parsimony goodness of Fit Index; AIC = Akaike's Information Criterion

Table 5-11

Comparison of standardised regression weights and model variance for trimmed and validated models of Current EBP use

Trimmed model (Episode 1 data; n = 162)					**Validated model (Episode 2 data; n = 48)**				
Variables		**Standardised regression weight (β)**	**Level of sig**	**R^2**	**Variables**		**Standardised regression weight (β)**	**Level of sig**	**R^2**
Direct influence					**Direct influence**				
EBP beliefs	EBP current use	0.228	0.002		EBP beliefs	EBP current use	0.271	0.021	
EBP self-efficacy	EBP current use	0.190	0.005		EBP self-efficacy	EBP current use	0.296	0.009	
Sources of EBP self-efficacy	EBP current use	0.438	<0.001		Sources of EBP self-efficacy	EBP current use	0.416	<0.001	
Indirect influence					**Indirect influence**				
EBP beliefs	Sources of EBP self-efficacy	0.516	<0.001		EBP beliefs	Sources of EBP self-efficacy	0.408	0.002	
EBP beliefs	EBP Self-efficacy	0.452	< 0.001		EBP beliefs	EBP Self-efficacy	0.521	<0.001	
Sources of EBP self-efficacy	EBP self-efficacy	0.193	0.010		Sources of EBP self-efficacy	EBP self-efficacy	0.129	0.319	
EBP self-efficacy	EBP outcome expectancy	0.712	0.002		EBP self-efficacy	EBP outcome expectancy	0.537	<0.001	
Model variance				**0.50**					**0.60**

5.6 Summary of results

This chapter has presented the results from two episodes of data collection including sample characteristics and then the application of the data to several models using SEM principles. Factors predictive of and influential to undergraduate student's intention to use EBP were explored first as the main hypothesis for this study. The second model development aimed to identify factors predicting and influencing undergraduate health students' current use of EBP. Both models were fit with data from Episode 1 and then trimmed as necessary. The trimmed models were then validated with data from the second episode of data collection. Results identified several factors influential to the outcome variables and supportive of the underpinning theory. The results are discussed further in Chapter 6.

Chapter 6: Discussion

6.1 Introduction to discussion chapter

This chapter will present a discussion on the results and findings from Stages 1 and 2 of the research study. An extension of the discussion found in Chapter 3, regarding the systematic review from Stage 1, is first, followed by a discussion regarding the results of the modelling processes undertaken in Stage 2. The discussion will focus on variables that collectively predicted outcomes of undergraduate health students' intention to use EBP upon graduation and their current use of EBP during their undergraduate education programs. Accordingly, relationships among the variables in each of the prediction models are highlighted. Throughout the discussion, results will align with literature and underpinning theory. The discussion will then move to implications of this research for education in clinical and academic environments as well as implications for future research. The chapter will conclude with a section on limitations of the research study with greater focus on limitations to Stage 2 of the research as limitations of Stage 1 were presented in Chapter 3.

6.2 Stage 1: Systematic review of factors influencing undergraduate students' intention to use EBP

The first stage of this research presented a systematic review of prognostic and prediction studies that examined factors predicting undergraduate intention to use EBP in their practice. The process for the review followed the recommended practice for systematic review methods, namely following a published protocol (Refer

Appendix A), following a specific yet sensitive search strategy, having two reviewers select and appraise the studies and assessment of risk of bias of included studies using a validated tool (Hayden et al., 2012).

The methodology for systematic reviews of prediction modelling studies is growing (Haydn et al., 2013; Hueget et al., 2013; Moons et al., 2015), therefore findings of the review should be read in context of a developing methodology. At the commencement of this review, no framework was available specifically for synthesising educational prediction studies. Critical appraisal tools for experimental and observational studies were not deemed sufficient to examine the unique characteristics of modelling studies and although the Joanna Briggs Institute were further developing tools for other epidemiological designs, none were available that were specific to modelling research. Consequently, review methods followed guidance of the Cochrane Prognostic Methods Group, whereby the Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis (TRIPOD) tool (Moons et al., 2015) was used to assess reporting characteristics and the Quality in Prognostic Studies (QUiPS) tool (Haydn et al., 2013) was used for assessing bias of included studies. Although initially developed for clinical prognostic studies the tools proved to be relevant and appropriate for studies on undergraduates' intention to use EBP.

The systematic review formed a crucial component of the overall research as the process enabled clear identification of factors influential to the outcome. These factors were subsequently considered for inclusion in the multivariate models for Stage 2 of the study. Historically, systematic review methods provide confidence in results of a treatment or intervention through combining individual studies on a specified topic, regarding treatment of diagnosed conditions (Croft et al., 2015; Higgins & Green., 2008). The aim of prognostic studies however, is to identify factors that predict the likelihood of a pre-determined outcome (Croft et al., 2015) and such studies are predominantly reported on patient-focused, clinical outcomes. For this current research, the systematic review method was applied to a clinician education context, with the aim of identifying learner-focused outcomes. Utilising the process to identify such factors provided confidence in selecting independent variables for entering into the subsequent prediction modelling designs in Stage 2 of this study. The method also enabled analyses of the effect of such variables on the specific outcome of undergraduate student's intention to use EBP after graduation. The methodology used to guide the systematic review was sound but was exploratory in nature as discussed above. Continued development and refinement of the systematic review methods for such studies will benefit educators and curriculum developers as it will provide greater confidence in identifying factors that influence student success.

Three studies met criteria for inclusion in the review, identifying seven factors influential to undergraduate students' intention to use EBP and/or their future use of EBP in their professional clinical environments. These factors were journal subscription, EBP familiarity, EBP attitudes, confidence in clinical decision making, EBP capability beliefs, being prepared for clinical placements, and educational support for EBP both in the clinical and academic environments. The item of EBP familiarity was not as clearly defined as the other variables, hence it was not included in the prediction model in Stage 2. Journal subscription was also excluded from the prediction model, as it was included in the study by Brown et al., (2010) to establish baseline literacy skills for the sample in their study. Although identified as influential to students' future use of EBP, literacy skills were not specifically measured in this current research study. The variable was also not measured in any of the other studies in the systematic review consequently, there was less support for including it in the prediction models in Stage 2. A systematic review by Harris et al., (2011) on the effectiveness of journal club subscription on health professional student and practitioners' decision-making identified mixed results. The authors suggested further research is needed to ascertain how components within the journal club impact clinician's use of the research for their clinical decisions. This was not the focus of the current research study; therefore, journal club subscription was not included as a variable for Stage 2 of the research. The remaining variables of EBP attitudes, confidence in clinical decision-making, EBP capability beliefs and educational support were considered for inclusion in the hypothesised prediction models in Stage 2.

The systematic review comprised two studies from the discipline of nursing and one from social work, therefore extrapolating the results to all disciplines may not be appropriate at this stage. More prediction modelling studies in different disciplines would assist to determine the generic nature of EBP intention, or more specifically, to identify if undergraduates across different health disciplines do intend to engage in EBP after they graduate. Such studies would identify attributes that may be discipline specific or common across different fields.

Variables pertaining to students' preparedness for clinical placements, EBP capability beliefs and level of confidence with making decisions influenced future use of EBP. The overlapping of the concepts of preparedness and confidence provide a basis for exploring the complexity of how best to support student EBP capability for their clinical environments. Fraser & Greenhalgh (2001) identified the need for educators to support and develop capability as an extension of competence. The authors specified competence as, "what individuals know or are able to do in terms of knowledge, skills and attitude (p. 799)", while capability extends from this toward demonstrating a level of adaptability and flexibility which enables continued improvements in knowledge and performance. Thistlewaite et al., (2014), suggest that despite an increase in competency-based interprofessional education, there is still some debate over definitions of competency and capability in inter-professional contexts. The increasing trend for new healthcare graduates being required to have a level of EBP capability upon graduation, points to the need for more research within and across disciplines to ascertain the most effective ways to develop and sustain such capability. In order to reach a determined level of capability, individuals need a strong belief in their ability to achieve the particular task (Bandura, 1977), hence capability is linked to, but slightly different from, a person's self-efficacy. Support is required within learning environments to ensure development of students' self-efficacy in order for them to attain required capabilities.

EBP educational support in both clinical and academic environments was found to have influenced student's intention to adopt EBP behaviours (Brown et al., 2010; Forsman et al., 2012). The learning environment for students in health professional undergraduate courses extends beyond physical locations to incorporate people around them, including teachers and peers (Gloudemans, 2013). Environment is also influenced by behaviour (Bandura, 1977). Educational psychology supports the concept that student perception of their learning environment can affect their confidence to perform given tasks (Ames & Archer, 1988; Bandura, 1977), hence greater attention to this factor is proposed. It is feasible that educational support and subsequent EBP capability are intertwined which suggests more research is required to understand the complexity. Learning environment is an integral part of Bandura's social cognitive theory (SCT), consequently studies grounded in SCT for undergraduate students' may provide greater understanding of the interactions between environmental components of EBP education programs and subsequent EBP behaviours.

Due to the small number of included studies and variation across the studies, the overall evidence was found to be of weak to moderate quality. The systematic review can however, be used as a base for extending discussions on developing EBP capability, via enhancing capability beliefs, in undergraduate students to support current mandates for incorporating evidence in clinical practice. The findings of the systematic review suggest undergraduate students do intend to engage in the EBP process while they are at university despite external and intrinsic influences. Such influences should be addressed if they are expected to attain a level of capability for using evidence in their practice after graduation. Only one included study (Forsman et al., 2012) used Bandura's self-efficacy construct as a basis for their variable of EBP capability beliefs. Bandura defined perceived self-efficacy as one's belief in their capability to generate effort (Bandura, 1994), therefore the terms capability belief and self-efficacy are often used interchangeably. The use of social cognitive theory as the basis of health professional behaviour change interventions has been identified as an avenue for further EBP education and behaviour research (Godin et al., 2008; Greenhalgh et al., 2014; Michie et al., 2004) and was used subsequently used as a framework for Stage 2 of the research.

Overall, the systematic review conducted as Stage 1 of the research presented some evidence of belief in EBP capability and a level of confidence within the clinical environment as being the most influential factors for undergraduate student's intention to use EBP intention after graduation. Attitudes towards EBP and support within clinical and academic learning environments were also identified as influential to some degree although further research with larger samples and across disciplines is recommended to support this. The following section will discuss Stage 2 of the research according to results presented in Chapter 5.

6.3 Introduction to Stage 2 model development

The aim of Stage 2 of the research study was to identify factors that influence undergraduate health students' intention to use EBP in their professional practice as well as factors influencing their use of EBP during their course. A further aim was to determine if Bandura's self-efficacy construct, as part of social cognitive theory, was an appropriate framework for predicting such influences. Two multivariate prediction models were developed and validated with two separate episodes of data collection, to investigate these aims. Each data collection sample comprised undergraduate students enrolled in different years of nursing and/or paramedicine courses. The first model had the outcome of Intention to use EBP while the outcome variable for the second model was Current EBP use. Each model was based on Bandura's self-efficacy construct as part of social cognitive theory (Bandura 1977, 1997), which proposes that although humans are agents for their own behaviour, there are individual, behavioural and environmental factors that can influence their behaviour. The following sections will discuss the overall model findings and then highlight direct and indirect significant factors found to be influential on outcomes.

The initial hypothesised model for the outcome of Intention to use EBP, included five independent variables of EBP beliefs, EBP self-efficacy, Sources of EBP self-efficacy, EBP outcome expectancy and EBP current use. These variables were determined from significant bivariate relationships in the correlation matrix, after initially being identified and supported by the systematic review, literature and theory. Tools that were consistent with the theory underpinning the study (Bandura., 1997; 2004) were available to measure each of the independent variables. The strength of developing such a model based on theory is that it extends from an already well-developed base of knowledge (Michie & Abraham, 2004). The following sections discuss the findings of Stage 2 of the research in detail.

6.3.1 Factors influencing undergraduate health students' intention to use EBP

The hypothesised model for Intention to use EBP required trimming after fitting the data, as potential interactions between included independent variables had not been previously determined. The trimmed model presented a good fit as supported by model fit indices, with the overall model explaining 25% of the variance of undergraduate health students' intention to use EBP. The variable of

EBP beliefs was identified as the only factor to have a direct and significant influence on the outcome of student intention to use EBP.

Validation of the model in a second sample of students from a different time point in their program identified an overall variance of 18%. Although less variance was explained in this second sample, the results of initial and validation testing of the model both represent a medium to large effect size (Cohen, 1992; Cohen et al., 2013). Consequently, it was determined EBP self-efficacy, EBP outcome expectancy, sources of EBP self-efficacy, EBP beliefs and Current EBP use all had an influence either directly or indirectly, on student's intention to adopt EBP behaviours after they graduate.

Direct and indirect relationships between variables have all contributed toward overall model variance, with both trimmed and validated models identifying personal, environmental and behavioural factors contributing toward undergraduates' intention to adopt EBP behaviours. To examine the model results further, in the context of Bandura's self-efficacy theory, the factors and significant relationships between factors are represented in Figure 6-1. The figure identifies EBP self-efficacy and Sources of self-efficacy as intervening factors, indirectly influencing the outcome of intention to use EBP, thus aligning with Bandura's (1977, 1997) theory. Actual behaviours after graduation were not measured in this study, therefore it is possible that actual behaviour will vary from intended behaviours. However, the outcome of intention has been reported as an appropriate and predictive factor toward behaviour in many studies of health professionals' behaviour (Eccles et al., 2006, 2007; Godin et al., 2008).

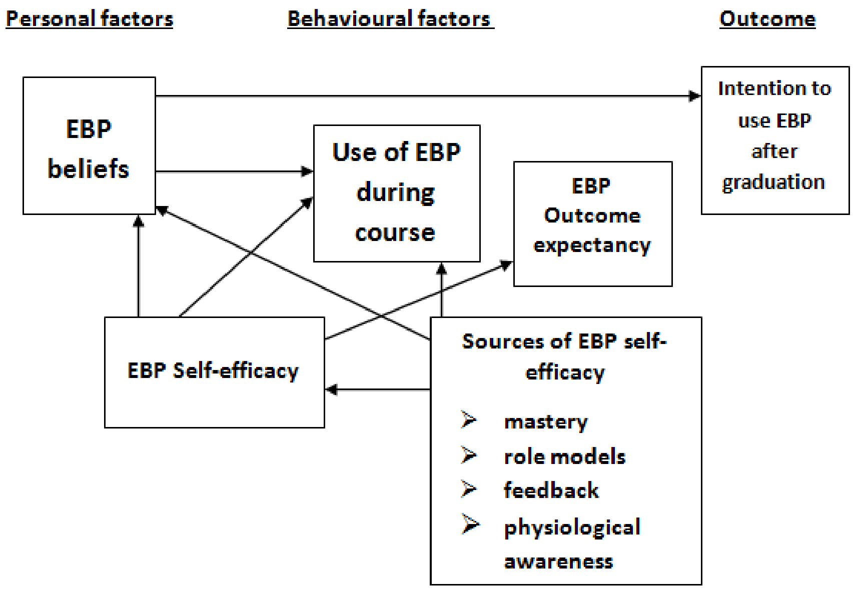


Figure 6-1: Visual representation of model factors and influences for outcome of Intention to use EBP

To-date, research on EBP education in undergraduates has predominantly focused on short-term changes in domains of knowledge, attitudes and to a lesser extent, skills and competence. Such studies are important and necessary to the development of fundamental EBP skills in undergraduate students. The modelling process in this study has extended the topic of EBP education for undergraduate student through identifying predictive value of the relationships between self-efficacy, sources of self-efficacy and EBP beliefs. Forsman et al., (2012) reported EBP capability beliefs were predictive, to a small degree, toward nursing students' intention to use EBP, however the model presented in this current research identifies predictive influences of relationships between capability beliefs (in the form of self-efficacy) and other variables, on the outcome. Thus, it is proposed that EBP educational strategies based on Bandura's four information sources that focus on building student EBP self-efficacy and EBP beliefs, through improving EBP self-efficacy, will have greater influence over students' intention to use EBP in their professional practice.

Although the model was able to account for 18-25% of variance for Intention to use EBP, a significant portion of variance was not able to be determined, suggesting there are additional factors that influence students' intention to incorporate evidence in their practice after they graduate. Some factors in the model were found to be contingent on others, for example, the preceding influence of self-efficacy affected student's belief in the value of EBP and the way in which self-efficacy was developed influenced the student self-efficacy for EBP. These factors will be discussed in more detail below, but results suggest actions such as having opportunity to master EBP skills (not just recall them) and observing practices in clinical and academic environments were integral factors within the EBP education programs as ways of building student self-efficacy (Bandura, 1977, 1997).

The validated model was a poorer fit than the trimmed model when comparing model fit indices. This may have been a reflection of the smaller sample size in the second episode of data collection or the fact that students in the first sample were just starting their EBP unit and their initial interest in the unit led to overinflated responses. Alternatively, it may be that students in the second sample, who were closer to completing their course, had slightly less intention overall to use EBP in practice. A significantly lower mean score was found in the third and final year cohort for implementing the evidence, as subscale 3 of the EBP self-efficacy scale, compared to the first data collection episode from more junior students. Similar results have been reported by other authors (Forsman et al., 2012; Florin et al., 2012) where nursing students close to completing their course reported low intention to use research evidence in practice after graduation. Such results require further investigation to identify barriers to EBP at that particular phase of their course. Florin et al., (2011) identified differences within three universities regarding provision of support for EBP, which led to final year students reporting various levels of EBP preparedness across the different institutions. It is feasible therefore, that results in this current study are specific to the university where the students were enrolled. Alternatively, it is considered that regardless of their academic experience, students nearing completion of their study require greater ongoing support and encouragement in both academic and clinical environments (Forsman et al., 2011), prior to transitioning to professional practice. Greater collaboration between universities and clinical areas has been proposed to assist and support students to address potential challenges (Florin et al., 2011). However it is important to also acknowledge the critical influence of the support from clinical role models, as in their final year of study, students are forming their own professional identity and thinking about how they will be accepted into their working environment (Kennedy, Kenny & O'Meara, 2015). As such, EBP behaviours may not be deemed a priority, especially if they are not exposed to such behaviours prior to graduating.

Studies exploring student transition to the work environment, across different health professions, report many challenges in translating learnt knowledge to practice (Higgins et al., 2010; Kennedy et al., 2015; Moriarty, Manthorpe, Stevens & Hussein, 2011). A scoping review on paramedic student transition to the workforce identified the importance of educational support in clinical placements to assist in decreasing the theory-to-practice gap (Kennedy et al., 2015). Higgins et al., (2010), reported a similar finding in their systematic review on experiences and perceptions of newly qualified nursing students, however the authors specify pre-registration education within both clinical and academic environments influences student preparedness when first working in their new role. Clinical and educational support is crucial to transitioning roles from student to practitioner (Forsman et al., 2011; Higgins et al., 2010). However, student perceptions suggest insufficient time as well as varying quality of education during clinical placements, influence confidence upon graduation (Higgins et al., 2010; Kennedy et al., 2015). While the studies above highlight the need for pre-registration support in general, the results of the prediction modelling in the current research further reinforce the critical need for adequate support in both clinical and academic environments, particularly for students in their final year, in order to build EBP self-efficacy. Without such support students may revert to a more pragmatic and fundamental level of patient care (Brown et al., 2010).

For both episodes of data collection, significant relationships were identified between EBP self-efficacy, Sources of EBP self-efficacy, use of EBP and EBP beliefs. For the current model of intention to use EBP, the personal factor of EBP beliefs contributed the greatest weight and was the only variable directly influential to the outcome of intention to use EBP. This will be discussed further in the following section.

6.3.1.1 Direct influence on Intention to use EBP

In both the trimmed and validated models, EBP beliefs was determined to be the main predictor for students' intention to use EBP after graduation (trimmed model: $\beta = 0.501$, $p = 0.001$; validated model $\beta = 0.419$, $p \leq 0.01$). It is important to clarify here, that EBP beliefs in this context, represent a measure of the value the student has toward the five-step EBP process, not individual belief in their EBP capability. Capability beliefs, as self-efficacy expectations, are discussed in section 6.3.1.2.

Belief in the value of EBP is known to be influential to successful EBP implementation in health professionals (Fineout-Overholt et al., 2004; Melnyk et al., 2001; Melnyk et al., 2008; Melnyk, 2013). Despite this, research on undergraduates' EBP beliefs currently reports on primary studies measuring short-term changes in EBP beliefs and/or attitudes before and after delivering an EBP teaching intervention (Cheng et al., 2012; Kim et al., 2009; Johnston et al., 2009; Ruzafa-Martinez et al., 2013; Sanchez-Mendiola et al., 2012; Leach et al., 2016). The modelling results suggest students' intention to use EBP after graduation was influenced by belief in the value of the EBP process, which may have been a reflection of their EBP education and/or their exposure to EBP in practice. EBP beliefs can be affected by content and delivery of EBP education courses (Melnyk, 2013) hence the call for EBP curriculum to be clinically integrated (Young et al., 2014) and relevant to the stage of the learner (Tilson et al., 2011). The model identified that as students' beliefs in the value of EBP increased, so did their intention to use EBP after graduation, thus highlighting the importance of fostering positive EBP beliefs throughout the duration of their degree.

Although EBP beliefs was the only variable to directly influence Intention to use EBP, variables of EBP self-efficacy and Sources of self-efficacy had direct influence on EBP beliefs in both the trimmed and validated models, thus presenting an indirect but significant impact on student intention to use EBP after graduation. The following section explores the factors and relationships between the factors, as seen in the model.

6.3.1.2 Indirect influences toward Intention to use EBP

The trimmed and validated models identified independent variables of Sources of EBP self-efficacy, EBP self-efficacy and EBP current use as having significant and indirect influence toward undergraduate student's intention to use EBP. Outcome expectancy was included in the hypothesised model but did not present with any influence on other factors in the model. This is discussed further below.

Sources of EBP self-efficacy had a significant influence on the level of EBP self-efficacy in the trimmed model with Episode 1 data and in the validated model tested with data from the second episode. This finding supports the model proposed by Bandura (1977, 1997), in terms of how a person can build their self-efficacy namely through four sources of experience: mastery, role modelling (vicarious experience), feedback and awareness of stress responses (Bandura 1977, 1997). While the current education programs were not specifically designed with Bandura's model in mind it may be that the programs did incorporate experiences of mastery, role models, providing feedback and gaining awareness of challenges of using EBP. Furthermore, the findings that the Sources of EBP self-efficacy were also influential in improving beliefs, as well as influencing use of EBP during their course also indicates the benefits of the EBP education programs received by students.

Measurement of students' perceptions of the extent to which different sources of self-efficacy were experienced, provides information on different facets of the educational environment, such as teachers, peers (Gloudemans et al., 2013), curriculum and/or the physical environment. Environmental factors exert strong influence over students' behaviour and motivation for learning (Gloudemans et al., 2013) and how a student perceives their learning environment can influence their motivation, goal setting and persistence (Bandura, 1977). Significant results were found for all five subscales of the sources of self-efficacy scale and across both data collection episodes, suggesting that although indirectly influencing intention to use evidence in future practice, the education component was critical toward students' development of their beliefs, self-efficacy, use and intention to use EBP in the future.

EBP self-efficacy had an indirect and significant influence on EBP beliefs, EBP current use and EBP outcome expectancy, therefore the importance of EBP self-efficacy as an indirect predictor for intention to use EBP is also highlighted in the model. Bandura defined perceived self-efficacy as an individual's belief in their capability (Bandura, 1994), hence the construct is often interchanged with the term EBP capability beliefs (Wallin et al., 2012; Florin et al., 2012; Forsman et al., 2012). Previous research supports self-efficacy as a predictor for EBP behaviours in professional practice of nurses (Bostrom et al., 2013), nurse and midwives (Chang & Crowe, 2011; Wallin et al., 2012) and at an organisational level (Abrahamson et al., 2012). The systematic review presented in Chapter 3 identified a level of belief in EBP capability and/or EBP self-efficacy was influential to student intention to EBP and the modelling process has confirmed this as a valid predictor, albeit indirectly, of student intention to incorporate evidence in their practice.

The model was able to delineate the difference between students' EBP self-efficacy and their EBP outcome expectancy yet outcome expectancy did not influence any other factor. Bandura (1977, 1997) proposes both self-efficacy and outcome expectancy are important influences on behaviour, however in this study, only self-efficacy, via its influence on EBP beliefs, influenced students' intention to use EBP upon graduation. Furthermore, while the influence of the sources of self-efficacy toward self-efficacy development, as outlined by Bandura (1977), was also supported in this model, so was the influence of sources of self-efficacy, indirectly, on outcome expectancy. Nevertheless, the modelling did not identify any link from outcome expectancy to either intention to use EBP upon graduation, or students' current use of EBP during their course.

Studies measuring EBP outcome expectancy as a separate construct in student and/or health professional populations are scant, however in a sample of registered nurses and midwives, outcome expectancy for EBP was found to be high despite generally low level of EBP efficacy (Chang & Crowe, 2011). Another study by Eccles et al., (2007) found outcome expectancy to be predictive of doctors' prescribing behaviours. Results from the model in this study cannot confirm outcome expectancy as a predictor for students' intention to use EBP, however the link between self-efficacy and outcome expectancy has been supported. It may be a reflection of the tool used or it may be that students recalled learnt knowledge from their EBP course as to what the desired outcomes of EBP were. Further investigation of the construct would be worthwhile to investigate why the high level of outcome expectancy did not have any influence on the outcome, especially considering Bandura proposes outcome expectancy is influential to behaviour and behavioural intention (Bandura, 1977, 1986).

The significant findings of the model suggest further attention to the influence of such variables in other student populations, is warranted. A second model, which explored factors influencing students' current use of EBP, was also developed, and is discussed in Section 6.3.2.

6.3.2 Factors influencing undergraduate health students' current use of EBP

A second modelling process was undertaken to investigate predictors for students' current use of EBP throughout their course. A multivariate model was developed and validated with two separate episodes of data collection from nursing and paramedic students from a range of academic levels (years 1, 2, 3, and/or 4), with the outcome of EBP current use. Although not a future outcome as is usual for prediction models, the model was still valid as it was investigating the influence of multiple variables on a single endpoint (Steyerberg et al., 2013).

The developed model initially identified 50% of the variance in undergraduate healthcare students' current EBP use, which increased to 60% in the validation model. According to Cohen (1992), this represents a large effect size and thus provides strong support for Bandura's theory as a framework for student EBP education. The independent variables included in the hypothesised model were students' sources of EBP self-efficacy, EBP beliefs, EBP self-efficacy and EBP outcome expectancy. After trimming and validating the models using principles of structural equation modelling (SEM), the variables of Sources of EBP self-efficacy, EBP beliefs and EBP self-efficacy were determined to be direct and significant influences to student use of EBP during their course of learning. The highest regression weight was found for Sources of EBP self-efficacy (β = 0.416), which as mentioned previously includes mastery experiences, vicarious learning experiences (role models), verbal feedback or persuasion and physiological and emotional awareness (Bandura 1977, 1997). A visual representation of the model is depicted in figure 6-2.

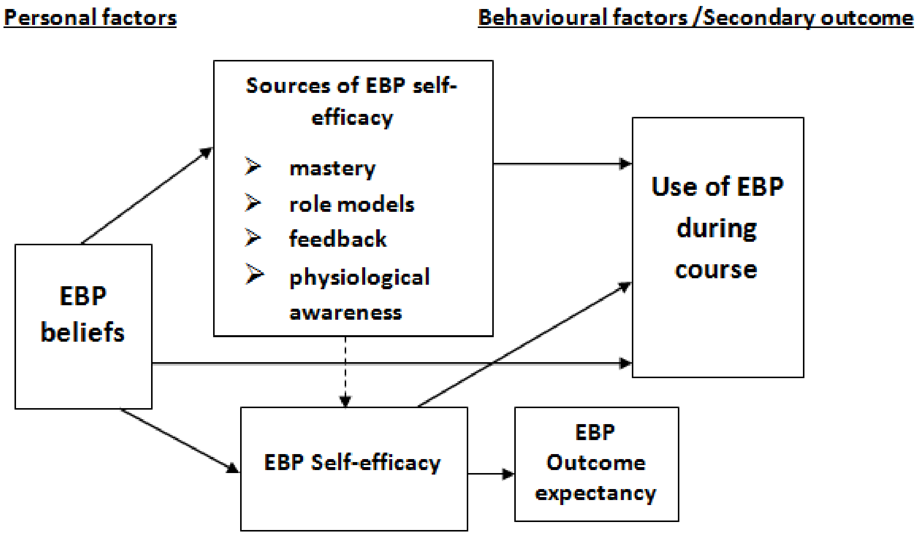


Figure 6-2: Visual representation of factors influencing undergraduate students' current use of EBP

Note: Dotted line from Sources of self-efficacy to EBP self-efficacy indicates different result between developed and validated model

Similar to the first prediction model, outcome expectancy again, did not have any influence on the outcome directly or indirectly, however students were able to ascertain to a high extent the anticipated result of each action of the EBP process. As mentioned previously, such a result requires further investigation as it does not support Bandura's proposal of the influence of outcome expectations on behaviour. The results for the relationships between EBP self-efficacy and EBP outcome expectancy were the same in both trimmed and validated models for each outcome of interest (trimmed model $\beta = 0.72$; validated model $\beta = 0.537$). This suggests greater likelihood of a limitation to the survey or the way the students perceived and/or responded to the items in the scale. As this was the first known use of the scale in student populations, further testing would be recommended to validate results in other student contexts.

Although the trimmed and validated models were able to explain 50-60% respectively, of variance for current EBP use, there was still 40-50% of variance unaccounted. Such a figure suggests there are still more unexplained factors or relationships that have not been captured in the model. Further research would be required to analyse the unexplained variance. The significant direct and indirect relationships between the variables are discussed in more detail below.

6.3.2.1 Direct factors influencing EBP current use

The three variables of EBP beliefs, Sources of EBP self-efficacy and EBP self-efficacy had direct influence on students' use of EBP during their course. The direct influence of EBP self-efficacy on EBP current use is consistent with Bandura's theory of the influence of self-efficacy in promoting behaviour (Bandura, 1977, 1997). Accordingly, student's self-efficacy for EBP could also affect their motivation, persistence and effort in learning and utilising the behaviours. As mentioned above, relationships between higher level of EBP self-efficacy and increased EBP activity in professional practice have been reported (Bostrom et al., 2013; Chang & Crowe, 2011; Wallin et al., 2012). Studies confirm self-efficacy as a predictor for EBP use in social work students (Shapira et al., 2017) and to a lesser extent in speech therapy students (Spek et al., 2013a). The model in this current study identified that higher levels of EBP self-efficacy in the sample of nursing and paramedic students, resulted in higher EBP use during their course. In addition, their self-efficacy for EBP was influenced not only by their belief in the value of EBP but for students in the first data sample specifically, EBP self-efficacy was also influenced by ways in which they could develop their EBP self-efficacy.

The influence of Sources of self-efficacy to developing personal self-efficacy is supported extensively by Bandura (1977; 1986; 1997; 2002; 2004). It was interesting therefore, to note that the path of Sources of EBP self-efficacy to EBP self-efficacy while in the hypothesised direction was not significant in the validated model, with data from the students in their third and/or final year. Although bootstrapping was a valid option to overcome any sample size limitations (Nevitt & Hancock, 2001; Schermelleh-Engel et al., 2003), the small sample may still have been an issue. Alternatively, such a finding may indicate some other issues specific to students at the end of their course that are not captured in the model. Reports of low EBP use in clinical environments from students close to graduation (Brown et al., 2010; Forsman et al., 2012; Florin et al., 2012; Olsen et al., 2014) and into their first few years of practice (Bostrom et al., 2013), support presence of such challenges. Brown et al.,

(2010) suggest that students near the end of their course are preoccupied with other academic and clinical requirements, which take precedence (Brown et al., 2010). While field of study may have been an undisclosed differentiating factor (McEvoy et al., 2010), it is also possible that students at this stage of their learning do not see themselves as being able to confidently implement evidence on their own (Florin et al., 2009), hence the lower self-efficacy score.

Despite the absence of a significant relationship between Sources of self-efficacy on EBP self-efficacy with the second sample, Sources of EBP self-efficacy were still directly influential, and to a large degree, on students' use of EBP, with results suggesting the educational programs provided opportunities for mastery experiences, feedback and modelling for students to build their EBP behaviours. Mastery experiences are suggested as the most powerful ways to build one's self–efficacy (Bandura, 1977) and repeated successful accomplishments are required to build persistence for behaviours, especially under difficult circumstances (Bandura, 1986). Consequently, to sustain a level of self-efficacy to enable persistence for overcoming challenges of EBP within practice environments, students would require opportunities to master elements of EBP in both academic and clinical environments (Forsman et al., 2012). Recommendations for clinically integrated EBP education have been promoted since the early 2000's (Coomarasamy & Khan, 2003; 2004). Despite this, lack of clinical EBP role modelling is reported to be a major barrier toward students' use of EBP in practice (Bozzolan et al., 2014; Brown et al., 2010). This is problematic to building student EBP self-efficacy, as students are unable to see how to perform EBP in their future professional workplace and such social comparisons are crucial toward building self-efficacy (Bandura 1977, 2012).

Comparing perceived ability to that of peers, tutors and other role models is a known mechanism for students in their development of a skill however such comparison can affect achievement, especially if the perceived ability is incongruent to actual ability (Bandura, 1993; Gloudemans, 2013; Pajares & Schunk, 2001; Schunk, 1990). Hence, modelling behaviours and feedback are crucial influences required for guiding students toward accurate judgment of their own ability (Bandura, 1977, 1997). Models in clinical and academic environments prove imperative to student and new graduates' motivation, development and use of evidence in practice (Bozzolan et al., 2014; Gloudemans, 2013; Gloudemans et al., 2013; Olsen et al., 2014; Wallin et al., 2012).

The variable of EBP beliefs again had direct influence on students used of EBP in their learning course. The regression estimates for this relationship were significant in both episodes of data collection ($p \leq 0.01$), which is interesting, as the students in the first episode of data collection would have had fewer opportunities for exposure to EBP due to less clinical exposure. This variable was also an indirect influence to students' use of EBP in practice, as further discussed in the next section.

6.3.2.2 Factors indirectly influencing EBP current use

As well as directly influencing the outcome, EBP Beliefs indirectly influenced current use of EBP via EBP Self-efficacy and Sources of EBP self-efficacy. It is feasible that students' initial value of the benefit of EBP was further influenced by experiences within their education and clinical programs. The direct influence of EBP beliefs on EBP use and EBP self-efficacy is the opposite of the first model where Intention to use EBP was the outcome. More specifically, in the first model the variables of EBP self-efficacy and Sources of EBP self-efficacy directly influenced EBP beliefs. It is difficult to know the reason for the reversed influence but one reason may be students' perceptions of the different time points for the outcome variables. It is feasible that students were able to quantify their current use of EBP more so than thinking about a future time point, as with their Intention to use EBP. Forsman et al., (2012) raised a similar issue with their model for nursing students' intention to use research evidence in practice, suggesting students may have had difficulty predicting their future working environments, limiting their ability to assume future EBP activity. Alternatively, it is possible that as students develop their EBP knowledge and skills, a cyclical process occurs of developing EBP beliefs, EBP self-efficacy and sources of EBP self-efficacy, which could be explored more deeply through further research.

6.4 Summary of modelling processes

The modelling processes in this research were underpinned by Bandura's self-efficacy theory (1977, 1997) and individual, behavioural and environmental factors were found to directly and indirectly influence contribute toward the respective outcomes of Intention to use EBP or EBP current use. The model findings provide an overall picture of factors influencing students' current use of EBP and intention to use EBP after graduation and highlight the crucial influence of the learning environment to support students' successful development of EBP and their transition to professional practice. Further testing of the model in different cohorts and disciplines will provide greater confidence in results but the model itself is strengthened by the underpinning theory.

The prediction modelling process was a valid and effective way to identify factors influencing a specific outcome. Being able to ascertain the relationships between the variables has also provided valuable information towards explaining a complex topic. Godin et al., (2008) suggest health professional's intention to adopt a particular clinical behaviour is influenced by belief in their capability for the behaviour. The model findings in this study suggest students have a similar capacity for aligning their EBP behaviour with their own level of EBP self-efficacy as well as their belief in the value of EBP. Each of these domains is strongly influenced by the ways in which they build their self-efficacy.

It is important to note that data collection for this modelling was conducted in one university and as such, there may be contextual elements to the EBP program unique to the campus, which may not have been captured. Some researchers suggest contextual and resources elements between universities can affect student EBP education and subsequent development and engagement (Flores-Mateo et al., 2007; Florin et al., 2012; Gloudemans et al., 2013; Widyahening et al., 2012). Reported contextual barriers for EBP clinical practice include lack of database access, limited resources and lack of organisational support (Dans & Dans, 2005; Greenhalgh et al., 2014; Oude Rengerink et al., 2011; Young et al., 2015). Applying Bandura's theory to the learning environment may assist students' to build a level of self-efficacy that will enable them to persist with challenges that are within their control.

6.5 Implications for teaching and learning

Recommendations in the literature for theory-based approaches to EBP education (Greenhalgh et al., 2014; Norman & Schmidt, 2000) were one impetus for this study, which has highlighted the importance of self-efficacy, as part of social cognitive theory (Bandura, 1977, 1997) to support student's developing self-efficacy for EBP. As the study was approached from a learning perspective, implications are proposed with the learner in mind. The research study did not originally aim to evaluate the EBP programs that students were exposed to however, findings of the model suggest elements of the students' EBP education did in fact influence their intention to use EBP and even more so, use of EBP during their course.

The four sources of information proposed to influence self-efficacy development include mastery, vicarious experience, feedback and awareness of one's physiological and psychological reaction to the task and were significant in influencing student intention to use EBP following graduation as well as for their current use of EBP during their course. Providing students with opportunities to increase their EBP self-efficacy is essential, if they are to feel confident in meeting registration requirements to use evidence in their practice after graduation. Recommendations for how and why each of these sources can be incorporated into EBP curricula are outlined below.

6.5.1 Mastery experiences

According to Bandura (1977, 1997), mastery experiences are the most powerful way of building one's self efficacy. Consequently, EBP curricula must provide opportunities for students to master individual skills as well as the overall process of EBP. Ensuring students have repeated opportunities to master fundamental information literacy skills would enable a solid platform for subsequent EBP development (Shorten & Crookes, 2001). Such skills also form a basis for developing clinical and critical enquiry, which can be developed throughout the duration of the course (Wolter et al., 2011) and subsequently carried into clinical practice (Melnyk, 2009). Florin et al., (2012), reinforce mastering the initial steps of EBP early, as practitioners who cannot formulate appropriate questions will be hindered in their attempts to implement EBP from the outset. Integrating steps of question formulation, searching and appraising literature into undergraduate units other than EBP curricula is also feasible, as these three steps on their own form a degree of information literacy that could be applied to any academic endeavour. Partnerships with library staff (Brown et al., 2010) and understanding organisational variations regarding information access (Wahoush & Banfield, 2014), are also important considerations for EBP educators to support and assist students in problem solving and feeling confident to use such analytical skills in their future practice.

Educators should be aware that students with high self-efficacy for information literacy skills might not have the same level of self-efficacy for other steps of the EBP process. Accurate assessment of mastered skills is essential to provide students with knowledge of their progress and level of attainment. As a majority of EBP measurement tools rely on student self-report, it is also important that educators are aware of the potential mismatch between students own belief in their EBP ability and their actual ability (Artino, 2012). According to Bandura (1977; 2006), self-efficacy is task specific and measuring mastery of tasks requires specific and corresponding evaluation mechanisms. Therefore, it is imperative that students are assessed on mastery of their EBP skills with appropriate tools that correspond to the domain in question. Such correspondence between the task being measured and specificity of the domain strengthens predictive power of perceived self-efficacy toward outcomes (Artino, 2012; Bandura, 1977, 1997; 2006). The inclusion of observational data on students' EBP performance would be invaluable in clarifying any disparities between students' self-report and more objective data.

Mastery experiences have potential to be transformational (Bandura, 1997; 2006) and as such should be an essential part of EBP curricula. Successful mastery experiences influence motivation and goal setting (Bandura 1977, 1997), therefore positive experiences with tasks such as finding and appraising evidence, disseminating evidence and being able to assess effects of implementing evidence can affect student's motivation and goal setting in regard to EBP. The opposite of this is just as powerful, in that negative and failed attempts will deter students from persisting (Bandura 1977, 1997). This reinforces the need for achievable and contextually specific EBP learning goals, as timing of such experiences will also influence future motivation (Bandura, 1977).

6.5.2 Vicarious experiences/role modelling

Providing positive modelling in academic and clinical environments is considered recognised as another powerful tool for building student EBP self-efficacy (Artino, 2012). Undergraduate curriculum that includes examples of successful and achievable EBP implementation projects at an appropriate level, would demonstrate applicability to practice at a level the students could appreciate

(Melnyk, 2013) and would encourage students to participate in the process. However, role modelling in clinical and academic environments is perhaps the most powerful influence on students for instilling beliefs on the relevance, achievability and benefit of EBP (Ilic, 2009; Spek et al., 2013a; Weibell, 2011). It is suggested that although students can develop self-efficacy for skills they can master independently, belief in their ability decreases for components of the EBP process that require a level of collaboration, such as implementation (Bozzolan et al., 2014; Florin et al., 2012), hence the importance of EBP role models demonstrating positive team work. If students are experiencing positive EBP modelling in the academic environment but limited observed EBP behaviours in practice, the gap between academia and clinical practice widens. Clinical facilitators or mentors who can bridge the gap between academic environments and clinical environments have a vital role in demonstrating to students the behaviours to aspire to (Bozzolan et al., Florin et al., 2012; Melnyk, 2007).

The use of video and/or simulated role modelling is a consideration for EBP teaching interventions, as information from various sources impacts on overall learning (Bandura 2006). However, such strategies must depict achievable goals and behaviours otherwise students can feel disheartened (Gloudemans, 2013). Learning through observing behaviour and seeing direct consequences of such behaviour is a powerful strategy (Bandura, 2006). Hence, simulation exercises incorporating clinically based scenarios could influence undergraduates to model positive behaviours. Simulation learning particularly for Millennial and final year students is reported to positively influence critical thinking development (Cant & Cooper, 2010; Tuttuci, Coyer, Lewis & Ryan, 2016) and can be used to explore gaps between perceived self-confidence and actual behaviour (Harder, 2010). Interactive and clinically integrated methods are known to be effective strategies for learning EBP (Khan & Coomarasamy, 2006; Young et al., 2014). Therefore, designing such interventions with live and/or simulated role modelling is supported, although evidence to specifically determine effectiveness of such approaches in achieving specific EBP outcomes is currently limited.

6.5.3 Verbal persuasion/feedback

Providing constructive and useful feedback to students regarding their EBP development is a vital component for EBP education, however this should come from clinical environments as well the classroom. Verbal and written feedback has power to support or very quickly undermine performance (Bandura, 1994; Weibell, 2011) and although reports suggest academic environments are more supportive of student EBP endeavours (Florin et al., 2012), consistent and constructive feedback across both environments is necessary to encourage students to engage in the EBP process (Bozzolan et al., 2014).

Students respond to fair, honest and definitive feedback given by those they respect (Bandura, 1997; Gloudemans, 2013; van Dinther et al., 2010). Such feedback provides a platform for them to modify behaviour accordingly (Artino, 2012; van Dinther et al., 2010), while vague or ambiguous feedback can lead to the student over or underestimating their level of self-efficacy (Artino, 2012; Bandura, 1977). Although a specific level of EBP attainment upon graduation is difficult to quantify, it is logical that undergraduate students would be required to acquire at least a fundamental level of knowledge and skill in the EBP process, which would be built upon over the years. Educators' must consider this when designing EBP courses and providing feedback.

6.5.4 Awareness of stress responses

The proposal of teaching students to identify within themselves their own reactions to difficult learning experiences (Tilson et al., 2011) is supported by this research as part of Bandura's fourth source of self-efficacy. Uncomfortable physical, emotional or psychological feelings can be interpreted as failure and consequently affect mood and performance (Bandura, 1994). Individual cognitive assessment of such stress states can impact greatly on student performance and motivation (Bandura 1977; 2006). This assessment may be misguided at times (Bandura 1977), which is where peers and/or role models can assist in providing a more accurate interpretation of the students' performance, particularly during reflection exercises (Gloudemans, 2013). As mentioned above however, feedback must be honest in order for the student to accurately interpret their level of discomfort. Supporting students to appreciate the complexities of EBP and acknowledge the recommendations for a life-long learning approach (Ilic, 2009; Dawes et al., 2005; Young et al., 2014), may help to overcome such stress responses.

Building students' own self-efficacy for and beliefs in the achievability and value of EBP should be a primary aim of curricula if students are expected to attain a level of EBP capability or competency upon graduation. Understanding the critical influence of EBP self-efficacy on attaining such requirements including ways to build EBP self-efficacy as outlined above, extends the discourse on EBP curriculum to consider inclusion of such strategies for undergraduate health students.

Students in their final year of their undergraduate courses appear to have extra challenges relating to developing their EBP self-efficacy. It is suggested that for this particular year level, reinforcing the value of EBP to patients and promoting pragmatic and achievable examples of EBP use, and providing repeated opportunities for mastering EBP skills are crucial strategies to sustain effects of EBP education programs. EBP education that builds across year levels may have greater influence than one-off EBP units may, however more research is required in this area. Support for students close to graduation must exist in both clinical and academic environments as they transition into professional practice, hence supportive links between university and clinical organisations are recommended.

6.6 Implications for future research

This study was exploratory therefore there are many areas for future research to consider in order to further the understanding of undergraduate students' use of EBP. Future research could include validating the multivariate prediction models in different contexts and different disciplines to identity the true generic nature of the model. Validating and updating the model with new, external data, rather than developing a new model is consistent with recommendations for more rigorous methods of externally validating prediction models (Bouwmeester et al., 2012). Such replication studies would be enhanced by comprising larger sample sizes thereby providing greater confidence in overall results and transferability of the model.

The context for the measurement scale for sources of self-efficacy (Gloudemans et al., 2013) was the clinical environment rather than the academic learning environment and subsequently identifies students' clinical placements as a context to practice and gain experience in developing EBP behaviours in order to improve their overall EBP self-efficacy. Despite the numerous amount of scales and tools available to measure domains of EBP learning (Shaneyfelt et al., 2006; Tilson et al., 2011), the scale developed and validated by Gloudemans et al., (2013), was the only one available at the commencement of the research to specifically measure sources of self-efficacy according to Bandura's self-efficacy construct (Bandura, 1997). Further validation of this scale would be beneficial using confirmatory factor analysis and data available from this current study. This would enable confirmation (or otherwise) of the five factors of self-efficacy in the current context. Modification of the sources of self-efficacy scale may be required or perhaps, a similar scale specifically focusing on ways in which students build their self-efficacy within academic environments, may need developing. Contextual elements for EBP learning environments such as resource availability or limitations, language barriers and/or organisational restraints could also be considered (Gloudemans et al., 2013; Flores-Mateo et al., 2007), as such elements may be influential to success or failure of EBP endeavours.

The modelling process itself is subject to further investigation. Clinical prediction models and prognostic research studies are being reported with greater frequency, yet using similar techniques for modelling in health education research is less prominent in the literature. More prediction modelling studies are required in other disciplines to test the generic nature of EBP intention across disciplines, or more specifically, to identify if undergraduates across different health disciplines do intend to engage in EBP after they graduate. Current reports of EBP implementation are sub-optimal (Kitson & Harvey, 2016; Straus et al., 2013), hence identifying attributes that may be discipline specific or common across different fields and will provide better indication of the magnitude of relationships between predictor and outcome variables, for each discipline.

Validating the models with the second episode sample of third and final year students identified a poorer fit to the model, suggesting there are other influences that require further investigation. It may be that the smaller sample size influenced the validation process or it could be that students in the latter years of their course did not see the value of EBP as strongly as they did in prior years. Students completing the first round of data were just commencing an EBP unit therefore were immersed in the idea of EBP. It is feasible that this inflated their responses, therefore further research into this is proposed. Further research would also be needed to investigate the reasons underlying more senior students report less benefit in using EBP. An in-depth qualitative study would provide deeper insight into how students approached the survey and their experiences with EBP in both clinical and academic environments. This may help to unveil reasons why outcome expectancy did not link to any outcome in either model process. A synthesis of qualitative studies on undergraduate student's experience of learning and developing EBP behaviours has not been found in the literature and would provide a global picture of challenges, barriers and facilitators regarding from the students' perspective.

6.7 Implications for policy

Clarifying actual levels of EBP capability or competency to meet registration mandates is a consideration from this research. Currently, different health professions have differing requirements and variation exists nationally and internationally. For example, a recent audit of Australian health professional registration documents (McEvoy, Crilly, Young, Farrelly & Lewis, 2016) found inconsistencies in the definition of evidence-based practice as well as a range of requirements relating to individual steps of the EBP process (Sackett et al., 1996), across 11 disciplines. Although this is only within one country, such variation poses challenges to educators particularly within interdisciplinary teams, as teaching and learning goals are not consistent. If undergraduates are expected to meet levels of EBP capability for professional accreditation, then the standards for which they are to strive toward must be clear.

The link between university policy and health professional licensing bodies must be considered also if students' EBP education is expected to meet predetermined levels of EBP capability. Swedish researchers (Florin et al., 2012; Forsman et al., 2009) have identified differences in preparedness for EBP across different universities within one country, suggesting variation exists between different campuses as well as concerning educational support in academic environments and clinical practice. This has been attributed to two issues, which have been supported in other countries, namely variation in education standards of EBP tutors in academic settings and lack of EBP use in clinical practice (Bozzolan et al., 2014; Dans & Dans, 2005; Young et al., 2015). As identified in this study, if clinical role models are lacking then students will not be able to model their own behaviours on observed ones, hence their EBP self-efficacy will be affected.

Finally, if clinical support for EBP is a major barrier to student EBP development, due to lack of role modelling, consideration must be made for pragmatic solutions to support EBP use in clinical areas. Evidence implementation is known to be complex and multi-faceted, and not the focus of this current study. However, use of evidence-based clinical policies, pre-appraised, evidence summaries (Bozzolan et al., 2014; Di Censo et al., 2009) as well as organisational support (Bostrom et al., 2013; Melnyk, Fineout-Overholt, Giggleman & Cruz, 2010) are essential to support clinicians' use of EBP. If students were able to observe use of such tools and practices, it would assist in building student self-efficacy to continue to practice EBP after graduation.

6.8 Limitations to the study

While the strengths of this study are the identification of the influence of several direct and indirect variables on students' intention to use EBP as well as their current use of EBP, underpinned by existing theory, there are some limitations. The limitations to Stage 1 were discussed in Chapter 3 (see section 3.9.4) therefore this section will refer to limitations for Stage 2 of the study. Firstly, limitations relating to the survey methods will be presented followed by limitations to sampling and analysis, modelling processes and measurement scales used.

6.8.1 Limitations to the survey methods

Response rates to online surveys are known to be low (Fan & Yan, 2010; Millar & Dillman, 2011) with Fan & Yan (2010) suggesting there are several areas of online survey development and delivery that can affect response rates. Content and presentation of any online survey can affect response rates (Fan & Yan, 2010). The survey in this research was lengthy, as it comprised eight measurement scales with varying lengths from six to 28 items. Students were informed verbally and in the information sheet that it could take 20–30 minutes to complete the survey. This was an overestimate but it is recommended to overestimate length required for completion rather than underestimate (Crawford, Couper, Lamias, 2001). Regardless, the length of the survey was still longer than the recommended time for college student surveys of 13 minutes or less (Fan & Yan, 2010). As the measurement scales were integral to the multivariate model development, it was not possible to shorten the survey yet it is acknowledged that a shorter version may have improved response rates. It is possible that the length of the survey created a level of cognitive burden (Porter, 2010), which may have resulted in some careless responses. Including strategies to enable detection of inattentive or careless responses (Huang, Curran, Keeney, Poposki & DeShon, 2011; Porter, 2011) would be valuable to eliminate such concerns for future surveys.

A gift card to the value of $100 was offered to students as a way of acknowledging the length of the survey, although it did not seem to affect the response rate especially for the second episode of data collection. Incentives are known to improve response rates (Millar & Dillman, 2011) especially in student surveys (Laguilles & Williams, 2010). Fan & Yan (2010) contend there is no direct relationship between type of incentive used and response rate and the most effective type of incentive is still undetermined, as supported in a study by Laguilles & Williams (2010). The researchers tested four different types of incentives offered to college students that were used to improve response rates. Results suggested all of the incentives had a positive impact in response, however ultimately the decision may be dependent on individual student characteristics (e.g. gender) or student need at the time (e.g. technology incentives).

It is suggested that an individual's decision whether or not to participate in a survey is heuristically determined by how the individual perceives the request for involvement as well as the importance they ascribe to the request for participation (Fan & Yan, 2010; Groves, Singer, Corning, 2000; Laguilles & Williams, 2010). It is feasible that many students felt the topic was not relevant or important to them and as such did not engage in the survey, regardless of the incentive provided. Conversely, the response rate may also indicate that those who completed the survey already have had some pre-conceived ideas or attitudes toward the topic, which may have an effect on the representation of the sample.

6.8.2 Limitations to sampling and analysis

Another limitation of this study, which aimed to identify undergraduate health students' intention to adopt EBP upon graduation, was the relatively smaller representation of students in the Paramedicine cohort. Although data collection for Episode 1 included sufficient numbers to meet the "10 per variable" guideline (Bouwmeester et al., 2012), there were significantly less responses from the paramedicine students than from nursing students. As the two cohorts of paramedicine and nursing students are the two largest health student populations currently in the university, it was thought there would be enough numbers to retrieve a representative sample. However, the total numbers of students enrolled in the courses differed at the outset. Despite repeated efforts to recruit students from both cohorts, and leaving the survey open for extra time in Episode 2, the response rate was still lower than desired.

Although bootstrapping can be used to address low sample sizes in SEM (Nevitt & Hancock, 2001; Schermelleh-Engel et al., 2003), the results of the model validations with the data from Episode 2 should be read in context of the limitation of representativeness of the sample. Inviting students from other health disciplines to complete the survey may have been a more appropriate option yet there would still have been a risk of significant differences between the groups according to type of course. The study aimed to explore EBP intentions from healthcare undergraduates who were from different disciplines but were all required attain a level of EBP competency upon graduation. Validating the model with a larger and broader sample, of different health disciplines with similar requirements for professional practice, would be beneficial and provide greater confidence in the generic application of the theory-based model. It is feasible that the different type of health discipline is actually a variable to be considered for inclusion in future models, even though it was not detected as such for this study.

A statistically significant difference between means for field of study was identified in the sample, which might have been a result of an imbalanced representation. It is feasible that although the EBP courses were similar, students from the two different fields of study may have been exposed to differences within their EBP courses or clinical experiences, influencing results yet not fully identified in the SEM analysis. The aim of the analysis was to use a generic approach to individual, behavioural and theory-related factors that influenced students' intention to use and current use of EBP. Structural equation modelling was an appropriate method for this aim, and analysis of the Chi-square test for each model enabled further identification of significant differences influencing model fit (Barrett, 2007), irrespective of field of study.

Listwise deletion of cases with over 50% of data missing resulted in a significant proportion of cases being excluded from the survey. Although such a process for handling for data missing completely at random, is supported (Schreiber, 2008), removing so many cases with incomplete responses did affect the sample size in this study. As mentioned previously, a shorter survey or different incentives may be avenues for improving survey completion and subsequent sample size.

Generalisability is a known limitation of educational studies from a single institution (Reed et al., 2005), and conducting the study within one university is a limitation to this research. The tools and methods could be applied to samples from other institutions to validate the model externally, which would provide greater confidence in results (Bouwmeester et al., 2012).

6.8.3 Limitations to scales used

The sources of self-efficacy scale (Gloudemans et al., 2013) focused on the clinical environment rather than the academic context. Despite numerous scales and tools available to measure domains of EBP learning (Shaneyfelt et al., 2006; Tilson et al., 2011), the scale developed and validated by Gloudemans et al., (2013), was the only one available at the commencement of the research to specifically measure sources of self-efficacy according to Bandura's self-efficacy construct (Bandura, 1997). No scale was found to specifically measure sources of EBP self-efficacy for students, within the academic environment. Although the construct of sources of self-efficacy that this tool measured was found to be a significant variable in the model explaining the factors influencing adoption of EBP upon graduation, additional studies of this tool are needed to determine validity in other populations. If such a scale were developed in the future, it would be interesting to compare sources of EBP self-efficacy in the academic environment to the clinical one.

Compared to the other scales used in the study, the EBP knowledge scale (Chang & Crowe, 2011) had not been validated as extensively and it is feasible that a different EBP knowledge scale could produce different results. For this study, the focus was student EBP self-efficacy and the scale for that domain was lengthy. It was a pragmatic decision to use an EBP knowledge scale that was short and appropriate for a generic context, appropriate for an undergraduate level. Level 1 instruments (Shaneyfelt et al., 2006) such as the Fresno (Ramos et al., 2003) and Berlin tools (Fritsche et al., 2002) have validated psychometric properties and test application of EBP according to the steps of the EBP process, but for this study a short, generic, objective measure was required to test student knowledge. Subsequently, EBP knowledge was not found to be influential to students' intention to use EBP or current use of EBP. Further validation of the EBP knowledge scale would be recommended.

Finally, it should be highlighted that the modelling represented a point in time of the student's course. Repeating the survey and modelling at different periods during the curriculum or into early years of professional practice could provide further evidence of any sustained behaviours or areas that need further attention. Although each prediction model was able to account for a percentage of variation of each outcome, there is still a significant amount of unaccounted variation. Thus, further research is suggested to identify other factors that may influence undergraduate health students' intention to use EBP and use of EBP during their courses.

6.9 Summary of discussion chapter

This chapter has presented a discussion on the findings of the research study on factors influencing undergraduate students' intention to use EBP and their current use of EBP. The results of the study indicate students' EBP beliefs, their self-efficacy for EBP and the way in which they build their EBP self-efficacy are all significant factors toward their intention to use EBP during their course and after they graduate. For students to build capability in the field of EBP and subsequently support licensing mandates, consideration must be given to these factors.

The following chapter will conclude the thesis. The hypotheses for the study will be revisited and a discussion will follow on whether the research hypotheses were rejected or supported. Conclusions from Stage 1 and Stage 2 of the study will be included in Chapter 7.

Chapter 7: Conclusion

7.1 Introduction

Consideration of low evidence implementation rates as well a requirements for students to incoprorate EBP into their professional practice upon gradauation, were the main motivators behind this research study. This thesis has presented a 2-stage research study, which aimed to examine the student EBP learning trajectory to identify factors influential to student EBP development and their intentions to incorporate EBP in their practice following graduation. It also investigated factors that influenced students' current EBP use during their degree.

The first stage of the research comprised a systematic review of prediction studies to identify factors from the literature that predicted students' intention to use EBP. Stage 2 of the research reported on model fit and validation processes of two hypothesised multivariate prediction models, underpinned by Bandura's self-efficacy construct, as part of social cognitive theory. Stage 2 also comprised two episodes of data collection, with the first episode of data being used to develop and fit the models, and the second episode of data collection used to validate the prediction models. Both samples comprised undergraduate nursing and paramedicine students however, for the first episode of data collection students were in their first and/or second year of their degree, while the second episode of data collection comprised students in their third and/or final year of study. Although students from these cohorts participated in different EBP courses at the university, both disciplines are required to integrate evidence into professional practice after they graduate. This research adopted a multi-disciplinary perspective, as integrating EBP across other health disciplines, within multi-disciplinary teams, is preferred, with the overarching goal of greater patient safety, and improved patient outcomes.

This chapter presents the conclusions of the research study. Firstly, a summary of each stage of the study is presented, prior to revisiting the hypotheses for the research. A discussion follows on whether the hypotheses were accepted or rejected, concluding with an overall summary of the research.

7.2 Summary of Stage 1

The aim of Stage 1 of the research study was to conduct a systematic review to synthesis research on factors that influenced undergraduate health students' intention to use EBP after graduation. To achieve this aim, prediction modelling studies from across health disciplines with the outcome of intention to use EBP, were analysed. Following an exhaustive search strategy from 2978 studies initially retrieved, only three studies were eventually included in the systematic review. Two studies were from the field of nursing while one was from the discipline of social work, hence although initially hoped that the systematic review would provide a view of student's intention to use EBP from across many disciplines, it is not possible to extrapolate results confidently to other disciplines. Synthesis of the studies identified low to moderate evidence (Huguet et al., 2013), hence additional rigorous modelling studies across other disciplines are recommended to improve confidence in the transferability of the results.

The systematic review and subsequent grading of the evidence was determined from using scales and tools that developed in clinical predictions models (Hayden et al., 2013; Huguet et al., 2013; Moons et al., 2015) and as such, results should be considered in the context of health professional educational studies. Reports on educational programs and interventions are known to be of varying quality (Cook et al., 2007; Phillips et al., 2014; Young et al., 2015). Despite these limitations, the few studies found suggest an urgent need for pragmatic and timely support for expanding the focus of research for EBP education, especially concerning undergraduate students. More specifically, further studies that not only teach knowledge and skills of EBP but also promote confidence for students to utilise such skills and knowledge are required.

Overall, the systematic review identified several factors influencing the outcome of students' intention to use EBP in their future clinical environments. Highlighted factors related to student confidence and preparedness for clinical practice as well as belief in their capability for conducting EBP, belief in the value of EBP and support from clinical and academic learning environments. Further examination of these factors, along with the literature regarding the topic and theory, supported the modelling processes in Stage 2 of the research study.

7.3 Summary of Stage 2

Stage 2 of the research study presented the development and validation of two multivariate predictions models. The first model had the outcome of Intention to use EBP while the second model reported on factors influencing undergraduate health students' current use of EBP during their degree course. Each of the models was grounded in the construct of self-efficacy theory as proposed by Bandura's Social Cognitive Theory (Bandura, 1977, 1997, 2002).

The independent variables for inclusion in the hypothesised models were developed following analysis of bivariate correlations between factors as determined from the systematic review developed in Stage 1 of the research, current literature and the relevant theory. Variables of EBP beliefs, EBP self-efficacy, Sources of EBP self-efficacy, EBP current use and EBP outcome expectancy, were initially included in the model. Data collected from nursing and paramedicine students in their first and/or second year were used to fit the first model with the outcome of Intention to use EBP. Results identified EBP beliefs as the only variable to directly and significantly predict student's intention to use EBP and overall the model explained 25% of variance for intention to use EBP. Validation of the model with a separate sample of data collected from third and/or final year nursing and paramedicine students presented a poorer fit to the data and lesser variance (18%), but did confirm EBP beliefs as the main predictor for students intending to adopt EBP behaviours after they graduate.

A second prediction model was developed and validated with the outcome of students' current use of EBP during their degree course. Results from the second modelling process highlighted source of EBP self-efficacy, EBP self-efficacy and EBP beliefs as significant, direct influences to EBP current use. The model was a good fit to the data and direct and indirect relationships explained 50% of variance of student's use of EBP during their degree. Validating the model with a sample from students toward the end of their degree resulted in a poorer fit according to the model indices; however, the overall variance increased to 60%. Such a large effect identifies that the greater the students' exposure to sources of self-efficacy, albeit perhaps to a greater proportion from their academic program, the more likely they were to use EBP during their degree. This effect was not sustained, as can be seen in the first model regarding student's intention to use EBP after graduation.

The influence of environmental support from both academic and clinical areas can be seen through understanding the impact of Sources of EBP self-efficacy, which comprise role modelling behaviours, positive feedback, mastery of skills and encouraging students' to be aware of physiological stress responses to learning and mastering EBP (Bandura, 1977, 1997). Although the influence of Sources of EBP self-efficacy to EBP current use was validated, the relationship between Sources of EBP self-efficacy to EBP self-efficacy was not significant with the second episode of data collection. The literature suggests different challenges exist for students closer to graduation (Brown et al., 2010; Forsman et al., 2012; Spek et al., 2013a). Although these factors have not been fully explained in the model, such challenges may relate to the learning environment, organisational or personal factors.

The amount of variance for the outcome of EBP current use was much greater than the result for students' Intention to use EBP suggesting students respond to EBP education programs but may have difficulty conceptualising what EBP means to them as a professional practitioner (Forsman et al., 2012; Spek et al., 2013a). Normalising EBP throughout curriculum rather than focusing on it as a separate way of practice, or as a 'one-off' educational unit, would assist in building on fundamental behaviours in a 'life-long' manner (Ilic, 2009; Dawes et al., 2005; Young et al., 2014). Alternatively, it may be as Forsman et al., (2012) suggest, that undergraduate students close to completion have other things in their mind regarding their future practice (e.g. employment), which have not been captured in this study.

Despite significant results from the modelling studies (which are summarised below in section 7.4), there was still a large amount of variance unexplained by each model. Consequently, the research study has not captured other influential factors. Such factors may be individual characteristics, discipline-specific or generic components however, more research with different disciplines and larger samples is required to ascertain this. Furthermore, timing may be a crucial component not fully captured in the modelling. Specifically, at the time the survey was conducted students in the final year of their study may not have been able to consider their future working environments hence their responses may have been influenced by such uncertainty. In contrast to this, students in the earlier years would have had less clinical exposure and their intention could have related to their next clinical placement, which was more certain. It is feasible that responses for this cohort would have been different if they were asked the same questions later in their course.

Timing is also a consideration relating to the factors in the models. It takes time to develop self-efficacy and beliefs toward any behaviour and although perceived self-efficacy is a predictor for future behaviour (Bandura, 1982), results of the model suggest at different times of the course, students levels of perceived EBP self-efficacy fluctuated. This reinforces the need for EBP programs that focus on sustained development and support with strengthened collaboration between clinical and academic environments. Without adequate role modelling it will be difficult for students to foresee behaviours required for effectively implementing EBP.

Limitations to the study (refer section 6.8) were reported as relating to the survey design, scales used and the samples for each episode of data collection. While the two student cohorts sampled represented the largest disciplines within the Faculty of Health at the university, numbers within the nursing and paramedicine schools were different at the outset. The aim of the research was to utilise a generic health undergraduate sample hence despite these limitations, the research presents a valid argument for the hypotheses, as discussed further below.

7.4 Revisiting the hypotheses for the research

Two hypotheses were proposed for the modelling processes in this research study, as presented below in the null form:

1. $H_{0:}$ There is no association between variables included in the theory based model and undergraduate students' intention to practice EBP after graduation.
2. $H_{0:}$ There is no association between variables included in the theory-based model and undergraduate health students' current EBP use.

For the first hypothesis, the theory based model identified EBP beliefs as having a significant association toward undergraduate health student's intention to use EBP after graduation. Other significant but indirect influences included EB self-efficacy and sources of EBP self-efficacy. The direct and indirect relationships between variables in the initial model accounted for 25% variation in intention to use EBP. The validated model identified a slightly smaller variance of 18% with the second episode of data collection. Each result represents a large effect size (Cohen, 1992) and thus, deemed significant. The null hypothesis is subsequently rejected as variables of EBP beliefs, EBP self-efficacy, Sources of EBP self-efficacy and EBP use, were all directly or indirectly associated with undergraduate health students' intention to use EBP after graduation. The variable of EBP beliefs was the only factor identified in both the trimmed and validated models, as being significantly and directly influential to undergraduate students' intention to use EBP.

For the second hypothesis, EBP beliefs, Sources of EBP self-efficacy and EBP self-efficacy had direct influence on students' use of EBP during their course. The developed model explained 50% of the variation in current EBP use, while the validated model using data collected in the second episode, identified 60% variation in students' current use of EBP during their course. Results of the modelling process subsequently identified that all variables in the models except for outcome expectancy, were influential directly or indirectly to the outcome. The second null hypothesis is also thus rejected and it is determined that the theory underpinning the model was appropriate for predicting current EBP use.

Interestingly the variable of outcome expectancy did not prove to influence outcomes in either model, directly or indirectly. This is a surprising find as Bandura's theory (1977, 1997) suggests individual expectation of the outcome of an action determines the individuals' decision to continue with the action. Examination of this finding, through further modelling studies, is proposed.

In summary, this study identified students' belief in the value of EBP as well as their EBP self-efficacy and the way they develop such EBP self-efficacy can predict and influence their use of and intention to use EBP in the future. As such, this study has provided groundwork for curriculum developers to consider when developing teaching strategies for undergraduate students to build EBP capability for meeting registration requirements upon graduation.

7.5 Conclusions of research study

This research study has provided a unique contribution to the discussion on undergraduate students EBP development EBP through development and validation of two multivariate prediction models that support Bandura's self-efficacy theory as a framework for undergraduate health students' learning of EBP. Effective learning of EBP requires incorporation of cognitive, affective, behavioural and environmental factors. Through developing and validating two multivariate models, this study has identified individual, behavioural and environmental factors that contribute to student's intention to use EBP in their professional practice and their current use of EBP. Further model validation in different disciplines and contexts, with larger sample sizes will ascertain the true generic nature of the models.

Self-efficacy is defined as a bridge between knowledge and action (Bandura, 1982). This study has provided evidence of self-efficacy as one factor necessary for supporting students in translating knowledge learnt from EBP education programs into clinical contexts. Results of the research and the theory underpinning this study, can be used by curriculum developers to extend EBP programs from content solely in the classroom to integrating EBP in the clinical environment in order to improve EBP utilisation and subsequent patient outcomes.

A critical element of Bandura's self-efficacy theory relates to the way in which individuals build their self-efficacy. Observing clinical EBP role models and having repeated opportunities to master elements of EBP are necessary components for students' EBP success post-graduation. Consideration of these factors, across year levels is necessary for determining requirements for student EBP self-efficacy; especially for students' transition to professional working environments.

Developing theory-based EBP education programs for undergraduate students can present challenges, however this study has presented Bandura's theory as an appropriate construct on which to base such programs. Educational curricula grounded in Bandura's self-efficacy construct has potential to support students' sustained development, use and intention to use EBP during their degree and in their future professional employment.

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Young, T., Rohwer, A., Volmink, J., & Clarke, M. (2014). What Are the Effects of Teaching Evidence-Based Health Care (EBHC)? Overview of Systematic Reviews. *PLOS ONE, 9*(1), e86706.

Young, T., Rohwer, A., van Schalkwyk, S., Volmink, J., & Clarke, M. (2015). Patience, Persistence and Pragmatism: Experiences and Lessons Learnt from the Implementation of Clinically Integrated Teaching and Learning of Evidence-Based Health Care – A Qualitative Study. *PLoS ONE, 10*(6), e0131121. doi: 10.1371/journal.pone.0131121

Zhang, Q., Zeng, T., Chen, Y., & Li, X. (2012). Assisting undergraduate nursing students to learn evidence-based practice through self-directed learning and workshop strategies during clinical practicum. *Nurse Education Today*, 32(5), 570-575. doi: http://dx.doi.org/10.1016/j.nedt.2011.05.018

Zimmerman, B. J. (2000). Self-Efficacy: An Essential Motive to Learn. *Contemporary Educational Psychology, 25*(1), 82-91. doi: http://dx.doi.org/10.1006/ceps.1999.1016

Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-Motivation for Academic Attainment: The Role of Self-Efficacy Beliefs and Personal Goal Setting. *American Educational Research Journal, 29*(3), 663-676. doi: 10.2307/1163261

Appendices

Appendix A

Record of protocol for systematic review on Strategies for teaching evidence-based practice to undergraduate health students

UNIVERSITY of York
Centre for Reviews and Dissemination

NHS
National Institute for Health Research

PROSPERO International prospective register of systematic reviews

Strategies for teaching evidence-based practice to undergraduate health students: a systematic review protocol

Mary-Anne Ramis, Anne Chang, Lisa Nissen

Citation

Mary-Anne Ramis, Anne Chang, Lisa Nissen. Strategies for teaching evidence-based practice to undergraduate health students: a systematic review protocol. PROSPERO 2015:CRD42015019032 Available from http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD42015019032

Review question(s)

The objective of this review is to find, critically appraise and synthesize the available quantitative evidence on the effectiveness of interventions that promote successful teaching of the evidence-based practice process in undergraduate health students, in preparation for them to become professional evidence-based practitioners.

More specifically, the question that this review seeks to answer is: What is the effectiveness of teaching strategies for evidence-based practice for undergraduate health students?

Searches

The search strategy aims to find both published and unpublished studies. A three-step search strategy will be utilized in this review. An initial limited search of PubMed and CINAHL will be undertaken followed by analysis of the text words contained in the title and abstract, and of the index terms used to describe article. A second search using all identified keywords and index terms will then be undertaken across all included databases. Thirdly, the reference list of all identified reports and articles will be searched for additional studies. Due to unavailability for translation resources, studies published in English only will be considered for inclusion in this review. Taking into consideration the Sicily Statement recommendations were published in 2005, this review will consider studies from 2005 to 2014.

The databases to be searched include:

PubMed

CINAHL

Scopus

ProQuest Health

ERIC

PsycINFO

Science Direct

Database of Abstracts of Reviews of Effects (DARE)

The search for unpublished studies will include:

Trove

Google Scholar

Conference proceedings

Page: 1 / 5

Appendix B

Record of Systematic review protocol for Factors influencing development of Evidence-based practice behaviours in undergraduate health students

UNIVERSITY of York
Centre for Reviews and Dissemination

NHS
National Institute for Health Research

PROSPERO International prospective register of systematic reviews

Factors influencing the development of evidence-based practice behaviours in undergraduate health students: a systematic review

Mary-Anne Ramis, Anne M. Chang, Lisa Nissen

Citation
Mary-Anne Ramis, Anne M. Chang, Lisa Nissen. Factors influencing the development of evidence-based practice behaviours in undergraduate health students: a systematic review. PROSPERO 2015:CRD42015029263 Available from http://www.crd.york.ac.uk/PROSPERO_REBRANDING/display_record.asp?ID=CRD42015029263

Review question(s)
The review question that is to be answered is, "What factors influence and predict undergraduate health students' use of evidence-based practice?"

Searches
The search strategy will include studies published from 2009 to 2015. This date has been chosen as an update to the Sicily Statement (Dawes et al., 2005), published in 2009 which provided direction on categories for educational assessment that should be considered when designing EBP courses (Tilson et al., 2011). Studies published in the English language only will be considered for inclusion in this review due to lack of resources for translation.

The databases to be searched include: PubMed, CINAHL, Eric, Scopus, PsycINFO.

The search for unpublished studies will include: Mednar, ProQuest dissertations and theses, The New York Academy of Medicine.

Example of PubMed search:

(((((("critical appraisal" OR knowledge OR skill OR Attitude* OR "self-efficacy" OR "self-confidence" OR value* OR behavio* OR intention OR Teaching OR Learning OR perception OR factor*[Title]))) AND ((((Undergraduate OR baccalaureate OR college OR freshman OR student))) AND evidence-based practice/)))) AND (((Randomized controlled trial) OR (non-randomized controlled trial) OR RCT OR (quasi-experimental) OR (before and after) OR Prospective OR retrospective OR (cohort stud*) OR (case-control) OR predict* OR prognos* OR model OR (cross-sectional) OR descriptive OR (epidemiological study designs))) AND ("2009/01/01"[PDat] : "2015/12/31"[PDat])

Filters: Humans; English.

Types of study to be included
As this review is looking at associations, the following correlational study designs will be considered for inclusion: predictive models, prospective and retrospective cohort studies, case control studies and analytical cross sectional studies. Correlational studies that follow students from their undergraduate year into the first post graduate year will also be included if they meet other inclusion criteria.

Condition or domain being studied
This review will examine studies on factors that influence the development of EBP behaviours, and predict intention to use EBP, specifically for undergraduate health students.

Participants/ population
This review will consider studies of undergraduate students from all health professions, including but not limited to medicine, nursing and allied health.

The review will exclude studies of postgraduate students and health professionals. Studies that report different

Appendix C

Systematic review search strategy

Database search strategy	Date	Results
PubMed (((quasi-experimental) OR Prospective OR retrospective OR (cohort stud*) OR (case-control) OR predict* OR prognos* OR model OR (cross-sectional) OR descriptive OR (epidemiological study designs)) AND evidence-based practice/) AND (Undergraduate OR baccalaureate OR college OR student) AND (("critical appraisal" OR knowledge OR skill OR Attitude* OR "self-efficacy" OR "self-confidence" OR value* OR behavio* OR intention OR Teaching OR Learning OR perception OR factor*[Title])) AND (("2009/01/01"[PDat] :"2015/12/31"[PDat]) AND English[lang])	Jan 2016	1519
CINAHL, ERIC and PsychInfo via EBSCOhost TI (critical appraisal OR knowledge OR skill OR Attitude* OR "self-efficacy" OR "self-confidence" OR value* OR behavio* OR intention OR Teaching OR Learning OR perception OR factor*) AND (Undergraduate OR baccalaureate OR college OR student) AND evidence-based practice AND (quasi-experimental OR Prospective OR retrospective OR cohort stud* OR case-control OR predict* OR prognos* OR model OR cross-sectional OR descriptive OR epidemiological study designs) Filter – English and years 2009-2015	Jan 2016	630
Scopus TITLE-ABS-KEY (evidence-based practice) AND (TITLE-ABS-KEY (critical appraisal) OR TITLE-ABS-KEY (knowledge) OR TITLE-ABS-KEY (skill*) OR TITLE-ABS-KEY(attitude*)OR TITLE-ABS-KEY (perception) OR TITLE-ABS-KEY (self-efficacy) OR TITLE-ABS-KEY (self-confidence) OR TITLE-ABS-KEY (value*) OR TITLE (factor*) OR TITLE-ABS-KEY (behavio*) OR TITLE-ABS-KEY (intention))AND (TITLE-ABS (undergraduate) OR TITLE-ABS(baccalaureate) OR TITLE-ABS (college) OR TITLE-ABS (student) OR TITLE-ABS-KEY (health professional, student)) AND TITLE-ABS-	Jan 2016	829

KEY (quasi-experimental) OR TITLE-ABS-KEY (prospective) OR TITLE-ABS-KEY (retrospective) OR TITLE-ABS-KEY (cohort stud*) OR TITLE-ABS-KEY (predict*) OR TITLE-ABS-KEY (prognos*) OR TITLE-ABS-KEY (model) OR TITLE-ABS-KEY (case-control) OR TITLE-ABS-KEY (cross-sectional) OR TITLE-ABS-KEY (descriptive) OR TITLE-ABS-KEY (epidemiological study designs) AND (LIMIT-TO(LANGUAGE,"English"))		
Proquest Dissertations & Theses Global ab(evidence-based practice) AND ab(undergraduate) (date and language filter applied)	Jan 2016	37
Mednar Evidence-based practice education (limit to pdf) Evidence-based practice education AND student Date limit 2009-2015	Jan 2016	 432 329
New York Academy of Medicine Key word search – evidence-based practice	Jan 2016	Nil relevant

Appendix D

List of Full text studies excluded from Systematic Review

Pre-appraisal

1. Alahdab, F., Firwana, B., Hasan, R., Sonbol, M. B., Fares, M., Alnahhas, I., . . . Ferwana, M. (2012). Undergraduate medical students' perceptions, attitudes, and competencies in evidence-based medicine (EBM), and their understanding of EBM reality in Syria. BMC Res Notes, 5, 431. doi: 10.1186/1756-0500-5-431
   Reason for exclusion: outcome of interest does not meet inclusion criteria
2. Ashktorab, T., Pashaeypoor, S., Rassouli, M., & Alavi-Majd, H. (2014). The effectiveness of evidence based practice education in nursing students based on Rogers's diffusion of innovation model. Middle East Journal of Scientific Research, 16(5), 684-691. doi: 10.5829/idosi.mejsr.2013.16.05.1192
   Reason for exclusion: Study design did not meet inclusion criteria
3. Bahammam, M. A., & Linjawi, A. I. (2014). Knowledge, attitude, and barriers towards the use of evidence based practice among senior dental and medical students in western Saudi Arabia. Saudi Med J, 35(10), 1250-1256
   Reason for exclusion: Study design did not meet inclusion criteria
4. Bozzolan, M., Simoni, G., Balboni, M., Fiorini, F., Bombardi, S., Bertin, N., & Da Roit, M. (2014). Undergraduate physiotherapy students' competencies, attitudes and perceptions after integrated educational pathways in evidence-based practice: a mixed methods study. Physiother Theory Pract, 30(8), 557-571. doi: 10.3109/09593985.2014.910285
   Reason for exclusion: Study design did not meet inclusion criteria
5. Brown, T., Tseng, M. H., Casey, J., McDonald, R., & Lyons, C. (2010). Predictors of Research utilization among pediatric occupational therapists. OTJR: Occupation, Participation and Health, 30(4), 172-183. doi: 10.3928/15394492-20091022-01
   Reason for exclusion: Study population did not meet inclusion criteria
6. Cheng, H. M., Guo, F. R., Hsu, T. F., Chuang, S. Y., Yen, H. T., Lee, F. Y., . . . Ho, T. (2012). Two strategies to intensify evidence-based medicine education of undergraduate students: a randomised controlled trial. Ann Acad Med Singapore, 41(1), 4-11.
   Reason for exclusion: Study design did not meet inclusion criteria
7. Elcin, M., Turan, S., Odabasi, O., & Sayek, I. (2014). Development and evaluation of the evidence-based medicine program in surgery: a spiral approach. Med Educ Online, 19, 24269. doi: 10.3402/meo.v19.24269
   Reason for exclusion: Study design did not meet inclusion criteria
8. Foss, E., J., Kvigne, K., Wilde Larsson, B., & Athlin, E. (2014). A model (CMBP) for collaboration between university college and nursing practice to promote research utilization in students' clinical placements: a pilot study. Nurse Educ Pract, 14(4), 396-402. doi: 10.1016/j.nepr.2013.11.008
   Reason for exclusion: Study design did not meet inclusion criteria
9. Florin, J., Ehrenberg, A., Wallin, L., & Gustavsson, P. (2012). Educational support for research utilization and capability beliefs regarding evidence-based practice skills: A national survey of senior nursing students. J Adv Nurs, 68(4), 888-897. doi: 10.1111/j.1365-2648.2011.05792.x

Reason for exclusion: outcome of interest does not meet inclusion criteria

10. Forsman, H., Gustavsson, P., Ehrenberg, A., Rudman, A., & Wallin, L. (2009). Research use in clinical practice—Extent and patterns among nurses one and three years postgraduation. J Adv Nurs, 65(6), 1195-1206. doi: 10.1111/j.1365-2648.2008.04942.x

    Reason for exclusion: Study population did not meet inclusion criteria

11. Forsman, H., Rudman, A., Gustavsson, P., Ehrenberg, A., & Wallin, L. (2012). Nurses' research utilization two years after graduation--a national survey of associated individual, organizational, and educational factors. Implement Sci, 7, 46. doi: 10.1186/1748-5908-7-46

    Reason for exclusion: Study population did not meet inclusion criteria

12. Ghahremanfard, F., Nassaji, M., Mirmohammadkhani, M., Tanha, A., Mosavi, M., Ghaemi, A., & Shams, P. (2014). Knowledge and attitude toward evidence-based medicine among medical students in Semnan, Iran. J Evid Based Med, 7(1), 32-37. doi: 10.1111/jebm.12084

    Reason for exclusion: Study design did not meet inclusion criteria

13. Halabi, J. O., & Hamdan-Mansour, A. (2012). Attitudes of Jordanian nursing students towards nursing research. Journal of Research in Nursing, 17(4), 363-373. doi: 10.1177/1744987110379782

    Reason for exclusion: Study design did not meet inclusion criteria

14. Hung, H. Y., Huang, Y. F., Tsai, J. J., & Chang, Y. J. (2015). Current state of evidence-based practice education for undergraduate nursing students in Taiwan: A questionnaire study. *Nurse education today*, *35*(12), 1262-1267.

    Reason for exclusion: Study design did not meet inclusion criteria

15. Ilic, D., Hart, W., Fiddes, P., Misso, M., & Villanueva, E. (2013). Adopting a blended learning approach to teaching evidence based medicine: a mixed methods study. BMC Med Educ, 13, 169. doi: 10.1186/1472-6920-13-169

    Reason for exclusion: Study population did not meet inclusion criteria

16. Ilic, D., Nordin, R. B., Glasziou, P., Tilson, J. K., & Villanueva, E. (2015). A randomised controlled trial of a blended learning education intervention for teaching evidence-based medicine. BMC Med Educ, 15, 39. doi: 10.1186/s12909-015-0321-6

    Reason for exclusion: Study design did not meet inclusion criteria

17. Jelsness-Jørgensen, L.-P. (2015). Does a 3-week critical research appraisal course affect how students perceive their appraisal skills and the relevance of research for clinical practice? A repeated cross-sectional survey. Nurse Educ Today, 35(1), e1-5 1p. doi: 10.1016/j.nedt.2014.09.008

    Reason for exclusion: Study design did not meet inclusion criteria

18. Johnston, J. M., Schooling, C. M., & Leung, G. M. (2009). A randomised-controlled trial of two educational modes for undergraduate evidence-based medicine learning in Asia. BMC Med Educ, 9, 63. doi: 10.1186/1472-6920-9-63

    Reason for exclusion: Study design did not meet inclusion criteria

19. Kritikos VS, Carter S, Moles RJ, Krass I. Undergraduate pharmacy students' perceptions of research in general and attitudes towards pharmacy practice research. International Journal of Pharmacy Practice. 2013;21(3):192-201

    Reason for exclusion: Study design did not meet inclusion criteria

20. Lai, N. M., & Teng, C. L. (2011). Self-perceived competence correlates poorly with objectively measured competence in evidence based medicine among medical students. *BMC medical education, 11*(1), 25

Reason for exclusion: outcome of interest does not meet inclusion criteria

21. Liabsuetrakul, T., Sirirak, T., Boonyapipat, S., & Pornsawat, P. (2013). Effect of continuous education for evidence-based medicine practice on knowledge, attitudes and skills of medical students. J Eval Clin Pract, 19(4), 607-611. doi: 10.1111/j.1365-2753.2012.01828.x

Reason for exclusion: outcome of interest does not meet inclusion criteria

22. Liabsuetrakul, T., Suntharasaj, T., Tangtrakulwanich, B., Uakritdathikarn, T., & Pornsawat, P. (2009). Longitudinal analysis of integrating evidence-based medicine into a medical student curriculum. Fam Med, 41(8), 585-588.

Reason for exclusion: outcome of interest does not meet inclusion criteria

23. Llasus L, Angosta AD, Clark M. Graduating Baccalaureate Students' Evidence-Based Practice Knowledge, Readiness, and Implementation. Journal of Nursing Education. 2014;53(9):S82.

Reason for exclusion: outcome of interest does not meet inclusion criteria

24. Long, K., McEvoy, M., Lewis, L., Williams, M., & Olds, T. (2011). Entry-Level Evidenced-Based Practice Training in Physiotherapy Students: Does It Change Knowledge, Attitudes, and Behaviours? A Longitudinal Study. Internet Journal of Allied Health Sciences & Practice, 9(3), 1-11 11p.

Reason for exclusion: outcome of interest does not meet inclusion criteria

25. Lovecchio, C. P., DiMattio, M. J., & Hudacek, S. (2015). Predictors of Undergraduate Nursing Student Satisfaction with Clinical Learning Environment: A Secondary Analysis. *Nurs Educ Perspect, 36*(4), 252-254.

Reason for exclusion: outcome of interest does not meet inclusion criteria

26. McCarty W. C., Hankemeier, D. A., Walter, J. M., Newton, E. J., & Van Lunen, B. L. (2013). Use of evidence-based practice among athletic training educators, clinicians, and students, part 2: attitudes, beliefs, accessibility, and barriers. *J Athl Train, 48*(3), 405-415. doi: 10.4085/1062-6050-48.2.19

Reason for exclusion: Study population did not meet inclusion criteria

27. McEvoy, M. P., Williams, M. T., Olds, T. S., Lewis, L. K., & Petkov, J. (2011). Evidence-based practice profiles of physiotherapists transitioning into the workforce: a study of two cohorts. BMC Med Educ, 11, 100. doi: 10.1186/1472-6920-11-100

Reason for exclusion: outcome of interest does not meet inclusion criteria

28. Nieman, L. Z., Cheng, L., & Foxhall, L. E. (2009). Teaching first-year medical students to apply evidence-based practices to patient care. *Fam Med, 41*(5), 332-336.

Reason for exclusion: Study design did not meet inclusion criteria

29. Rudman, A., Gustavsson, P., Ehrenberg, A., Bostrom, A. M., & Wallin, L. (2012). Registered nurses' evidence-based practice: a longitudinal study of the first five years after graduation. Int J Nurs Stud, 49(12), 1494-1504. doi: 10.1016/j.ijnurstu.2012.07.007

Reason for exclusion: Study population did not meet inclusion criteria

30. Sanchez-Mendiola, M., Kieffer-Escobar, L. F., Marin-Beltran, S., Downing, S. M., & Schwartz, A. (2012). Teaching of evidence-based medicine to medical students in

Mexico: a randomized controlled trial. BMC Med Educ, 12, 107. doi: 10.1186/1472-6920-12-107
Reason for exclusion: outcome of interest and study design do not meet inclusion criteria

31. Scholten-Peeters, G. G., Beekman-Evers, M. S., van Boxel, A. C., van Hemert, S., Paulis, W. D., van der Wouden, J. C., & Verhagen, A. P. (2013). Attitude, knowledge and behaviour towards evidence-based medicine of physical therapists, students, teachers and supervisors in the Netherlands: a survey. J Eval Clin Pract, 19(4), 598-606. doi: 10.1111/j.1365-2753.2011.01811.x
Reason for exclusion: outcome of interest does not meet inclusion criteria
32. Simons, L., Jacobucci, R., Houston, H., & Amoroso, K. (2011). Another look at the benefits of disseminating evidence-based practices: a comparative analysis of 2 undergraduate courses. Addictive Disorders & Their Treatment, 10(2), 60-71 12p. doi: 10.1097/ADT.0b013e3181fdfe0
Reason for exclusion: outcome of interest does not meet inclusion criteria
33. Spek, B., Wieringa-de Waard, M., Lucas, C., & Dijk, N. (2013). Competent in evidence-based practice (EBP): validation of a measurement tool that measures EBP self-efficacy and task value in speech-language therapy students. International Journal of Language & Communication Disorders, 48(4), 453-457 455p. doi: 10.1111/1460-6984.12015
Reason for exclusion: Study design did not meet inclusion criteria
34. Spek, B., Wieringa-de Waard, M., Lucas, C., & Dijk, N. (2013). Teaching evidence-based practice (EBP) to speech-language therapy students: are students competent and confident EBP users? International Journal of Language & Communication Disorders, 48(4), 444-452 449p. doi: 10.1111/1460-6984.12020
Reason for exclusion: outcome of interest does not meet inclusion criteria
35. Stronge, M., & Cahill, M. (2012). Self-reported knowledge, attitudes and behaviour towards evidence-based practice of occupational therapy students in Ireland. Occup Ther Int, 19(1), 7-16. doi: 10.1002/oti.328
Reason for exclusion: outcome of interest does not meet inclusion criteria
36. Tilson, J. K. (2010). Validation of the modified Fresno test: assessing physical therapists' evidence based practice knowledge and skills. BMC Med Educ, 10, 38. doi: 10.1186/1472-6920-10-38
Reason for exclusion: Study design and population did not meet inclusion criteria
37. Wallin, L., Bostrom, A. M., & Gustavsson, J. P. (2012). Capability beliefs regarding evidence-based practice are associated with application of EBP and research use: validation of a new measure. Worldviews Evid Based Nurs, 9(3), 139-148. doi: 10.1111/j.1741-6787.2012.00248.x
Reason for exclusion: outcome of interest and population do not meet inclusion criteria
38. Wallin, L., Gustavsson, P., Ehrenberg, A., & Rudman, A. (2012). A modest start, but a steady rise in research use: a longitudinal study of nurses during the first five years in professional life. Implement Sci, 7, 19. doi: 10.1186/1748-5908-7-19
Reason for exclusion: outcome of interest and population do not meet inclusion criteria

39. Waters, D., Crisp, J., Rychetnik, L., & Barratt, A. (2009). The Australian experience of nurses' preparedness for evidence-based practice. J Nurs Manag, 17(4), 510-518 519p. doi: 10.1111/j.1365-2834.2009.00997.x

Reason for exclusion: Study design did not meet inclusion criteria

40. West, C. P., Jaeger, T. M., & McDonald, F. S. (2011). Extended evaluation of a longitudinal medical school evidence-based medicine curriculum. J Gen Intern Med, 26(6), 611-615. doi: 10.1007/s11606-011-1642-8

Reason for exclusion: Study design did not meet inclusion criteria

41. Widyahening, I. S., van der Heijden, G. J., Moy, F. M., van der Graaf, Y., Sastroasmoro, S., & Bulgiba, A. (2012). Direct short-term effects of EBP teaching: change in knowledge, not in attitude; a cross-cultural comparison among students from European and Asian medical schools. Med Educ Online, 17, 19623.

Reason for exclusion: Study design did not meet inclusion criteria

42. Zhang, Q., Zeng, T., Chen, Y., & Li, X. (2012). Assisting undergraduate nursing students to learn evidence-based practice through self-directed learning and workshop strategies during clinical practicum. Nurse Educ Today, 32(5), 570-575 576p.

Reason for exclusion: Study design did not meet inclusion criteria

Post-appraisal (1)

Kim, S. C., Brown, C. E., Fields, W., & Stichler, J. F. (2009). Evidence-based practice-focused interactive teaching strategy: a controlled study. *Journal of Advanced Nursing, 65*(6), 1218-1227. doi: 10.1111/j.1365-2648.2009.04975.

Reason for exclusion: The study included some regression analysis however the main focus of the study was deemed to be effectiveness of the intervention.

Appendix E

QUIPS tool for risk of bias

Domains	Prompting items for Consideration	Ratings
Study Participation	a. Adequate participation in the study by eligible persons b. Description of the source population or population of interest c. Description of the baseline study sample d. Adequate description of the sampling frame and recruitment e. Adequate description of the period and place of recruitment f. Adequate description of inclusion and exclusion criteria	**High bias:** The relationship between the PF and outcome is very likely to be different for participants and eligible nonparticipants **Moderate bias:** The relationship between the PF and outcome may be different for participants and eligible nonparticipants **Low bias:** The relationship between the PF and outcome is unlikely to be different for participants and eligible nonparticipants
Study Attrition	a. Adequate response rate for study participants b. Description of attempts to collect information on participants who dropped out c. Reasons for loss to follow-up are provided d. Adequate description of participants lost to follow-up e. There are no important differences between participants who completed the study and those who did not	**High bias:** The relationship between the PF and outcome is very likely to be different for completing and non-completing participants **Moderate bias:** The relationship between the PF and outcome may be different for completing and non-completing participants **Low bias:** The relationship between the PF and outcome is unlikely to be different for completing and non-completing participants
Prognostic Factor Measurement	a. A clear definition or description of the PF is provided b. Method of PF measurement is adequately valid and reliable c. Continuous variables are reported or appropriate cut points are used d. The method and setting of measurement of PF is the same for all study participants e. Adequate proportion of the study sample has complete data for the PF f. Appropriate methods of imputation are used for missing PF data	**High bias:** The measurement of the PF is very likely to be different for different levels of the outcome of interest **Moderate bias:** The measurement of the PF may be different for different levels of the outcome of interest **Low bias:** The measurement of the PF is unlikely to be different for different levels of the outcome of interest
Outcome Measurement	a. A clear definition of the outcome is provided b. Method of outcome measurement used is adequately valid and reliable c. The method and setting of outcome measurement is the same for all study participants	**High bias:** The measurement of the outcome is very likely to be different related to the baseline level of the PF **Moderate bias:** The measurement of the outcome may be different related to the baseline level of the PF **Low bias:** The measurement of the outcome is unlikely to be different related to the baseline level of the PF
Study Confounding	a. All important confounders are measured b. Clear definitions of the important confounders measured are provided c. Measurement of all important confounders is adequately valid and reliable d. The method and setting of confounding measurement are the same for all study participants e. Appropriate methods are used if imputation is used for missing confounder data f. Important potential confounders are accounted for in the study design g. Important potential confounders are accounted for in the analysis	**High bias:** The observed effect of the PF on the outcome is very likely to be distorted by another factor related to PF and outcome **Moderate bias:** The observed effect of the PF on outcome may be distorted by another factor related to PF and outcome **Low bias:** The observed effect of the PF on outcome is unlikely to be distorted by another factor related to PF and outcome
Statistical Analysis and Reporting	a. Sufficient presentation of data to assess the adequacy of the analytic strategy b. Strategy for model building is appropriate and is based on a conceptual framework or model c. The selected statistical model is adequate for the design of the study d. There is no selective reporting of results	**High bias:** The reported results are very likely to be spurious or biased related to analysis or reporting **Moderate bias:** The reported results may be spurious or biased related to analysis or reporting **Low bias:** The reported results are unlikely to be spurious or biased related to analysis or reporting

Source: Hayden JA, van der Windt DA, Cartwright JL, Côté P, Bombardier C. Assessing bias in studies of prognostic factors. Ann Intern Med. 2013;158(4):280-6
Abbreviation: PF prognostic factor

Source:

Hayden, J. A., van der Windt, D. A., Cartwright, J. L., Côté, P., Bombardier, C. 2013. Assessing bias in studies of prognostic factors. *Annals of Internal Medicine*, *158*(4):280-6. Available from: Cochrane Prognosis methods: http://methods.cochrane.org/prognosis/our-publications

Appendix F

Measurement scale for Stage 2: Intention to use EBP scale

After graduation, I intend to:

	To a very low extent	To a low extent	To a high extent	To a very high extent
Formulate questions about clinical practice to search for current research based knowledge	☐	☐	☐	☐
Use databases to search for knowledge.	☐	☐	☐	☐
Use other information sources (e.g. books, journals, colleagues).	☐	☐	☐	☐
Appraise research reports.	☐	☐	☐	☐
Contribute to change in clinical practice by implementing current knowledge.	☐	☐	☐	☐
Participate in evaluating whether clinical practice reflects current knowledge.	☐	☐	☐	☐

Original scale from:

Wallin, L., Bostrom, A. M., & Gustavsson, J. P. (2012). Capability beliefs regarding evidence-based practice are associated with application of EBP and research use: validation of a new measure. *Worldviews Evidence Based Nursing*, 9(3), 139-148. doi: 10.1111/j.1741-6787.2012.00248.x

(Permissions obtained)

Appendix G

Measurement scale for Stage 2: Demographic questionnaire

Development of evidence-based practice in undergraduate health students
Demographic questions

1. How old are you? (age range 17-60; over 60 or prefer not to say)
2. Which field are you studying?
    - Nursing
    - Paramedicine
    - Nursing and Paramedicine (i.e. double degree)
    - Other - please specify:
3. Have you received any other formal university based study since leaving high school, in any field? If yes please select type:
    - Certificate
    - Diploma
    - Other Bachelor
    - Postgraduate course e.g. Masters
    - Other – Please specify:
4. Which year of study are you currently enrolled in?
    - 2nd year
    - 3rd year
    - Other (please specify
5. How many semesters of study have you completed of your current degree?
    - two
    - three
    - four
    - five
    - six
    - Other
6. Other than your university classes regarding evidence-based practice (EBP), have you had any other experience or formal training in EBP? For example, you may have a job in a health care setting where you have learnt about EBP from others. Yes/No

7. Have you (fully) completed an EBP unit during your course (e.g. CSB 600, NSB 019, other)? Note: if you are currently doing an EBP unit, please answer 'no'. Yes/No

8. Have you ever completed a university based research subject/unit? Yes/No
    - If yes, please indicate the type of research subject/unit:
    - General research methods
    - Epidemiology
    - Health Statistics
    - Other - Please specify:

Appendix H

Measurement scale for Stage 2: Evidence-Based Practice Knowledge Questionnaire

Evidence-Based Practice Knowledge Questionnaire - Chang, A. M., & Crowe, L. (2011). Validation of Scales Measuring Self-Efficacy and Outcome Expectancy in Evidence-Based Practice. *Worldviews on Evidence-Based Nursing, 8*(2), 106-115.)

- The questions are in multiple-choice format. Please read the questions carefully and indicate by circling your choice of the one best answer for each question.

- This part of the questionnaire is to find out about your knowledge of evidenced-based practice. Your responses to these questions will help us in further improving programs for evidence-based practice.

1. Evidenced-based practice is the use of:
   a) Practice as a way to generate research evidence
   b) Clinical decision making as a guide to research evidence
   c) Legal precedent as a guide to clinical decision making
   d) Evidence to guide clinical decision making
   e) Audit and performance data to guide clinical practice

2. The first step in evaluating research evidence for a clinical practice problem is to:
   a) Determine if your colleagues agree that the research is important
   b) State the problem as a clinical question
   c) Identify at least one study that deals with the problem
   d) Try and define the problem in general terms
   e) None of the above

3. Which of these sources of information provides a comprehensive database of systematic reviews?
   a) Cochrane library
   b) National Guidelines Clearinghouse
   c) Joanna Briggs Institute
   d) a and c
   e) a and b

4. The highest or strongest level of evidence for changing nursing practice is evidence from:
   a) A systematic review or meta-analysis of all randomised controlled trials
   b) The opinion of authorities and/or reports of expert committees
   c) Systematic reviews of descriptive and qualitative studies
   d) Well-designed case-controlled or cohort studies
   e) At least one well designed randomised controlled trial

5. When documenting the effects of a practice change, which of the following would be important evidence to collect?
    a) Long term patient responses
    b) Gained approval from credible key stakeholders
    c) Favourable results in similar settings
    d) All of the above
    e) a and c

6. Deciding on the quality of a systematic review (SR) requires critical appraisal of whether the review had:
    a) A precise statement of the research; searched several important databases; assessed the quality of included studies; combined the results of studies appropriately; recommended policy or practice change based on the evidence.
    b) A clearly focused question; searched all relevant databases; assessed the quality of included studies; combined results of studies appropriately; recommended policy or practice change based on the evidence.
    c) A clearly focused question; searched many databases; assessed the quality of all studies found; combined results of studies appropriately; identified the gaps in the research evidence.

7. For the next question please answer Yes or NO in the spaces provided for each of the points below:

Examine the clinical problem stated below and identify if the four essential PICO components are present:

Will multi-layered compression bandaging or single-layered compression bandaging be more effective in promoting healing for those with venous leg ulcers?

P	Yes	☐	No	☐
I	Yes	☐	No	☐
C	Yes	☐	No	☐
O	Yes	☐	No	☐

Appendix I

Measurement scale for Stage 2: Five factor model of Sources of Self-Efficacy

Source: Gloudemans, H., Schalk, R., Reynaert, W., & Braeken, J. (2013). The development and validation of a five-factor model of Sources of Self-Efficacy in clinical nursing education. *Journal of Nursing Education and Practice, 3*(3), p80.

Tool modified with permission

Mastery experiences

1. I had many opportunities to provide care
2. I developed many clinical competencies through providing actual care (changed from 'nursing')
3. I learned a lot about care situations in real clinical settings (changed from "on a ward")
4. Providing good care gave me a sense of personal success
5. There were opportunities to provide good care

Vicarious learning experts

1. I have learned a lot by watching registered nurses in action
2. Listening to registered nurses/registered paramedics who talk about care situations provided me useful information
3. I had many opportunities to observe registered nurses/registered paramedics in action
4. Observing registered nurses/registered paramedics in action is valuable to me

Vicarious learning peers

1. I developed self confidence in by observing mistakes made by peers
2. Observing peers under achieving, enabled me to learn to be more effective
3. Seeing peers performing well, gave me self-confidence I could perform well also
4. I often compared my actions with actions performed by peers

Verbal persuasion

1. I learn a lot about providing effective care via suggestions of others
2. Feedback I received, helped me to provide better care
3. I tend to believe registered nurses/paramedics who I respect, when they say I will become a good nurse/paramedic
4. Feedback gave me a sense of self-confidence

Physiological symptoms

1. When saying something wrong, I became tense
2. The idea of being in a 'real life' clinical situation, made me nervous (wording changed from "a nurse on a ward")
3. My fear of making mistakes, affected my capability to provide care
4. When making mistakes, I felt that my heart was beating faster and louder
5. When my actions did not succeed, I started to perspire

Appendix J

Measurement scale for Stage 2: Self-efficacy in Evidence –Based Practice (EBP)

Adapted from Chang, A.M., & Crowe, L.M. (2012). *Self-efficacy in Evidence-Based Practice Activities – Beta Version Manual*. Queensland University of Technology. Brisbane: Australia– Permission obtained from the primary author

For the next questions, think about your previous clinical placements and rate how **confident** you are in your ability to successfully accomplish each of the following activities. Each activity is related to the successful practice of evidence-based healthcare. In the boxes provided to the right of each activity, please indicate (by circling one number on each line) your degree of confidence, from 0 (no confidence at all) to 10 (extremely confident).

How confident are you in your ability to successfully accomplish each of the following activities?	**No confidence at all**					**Somewhat confident**					**Extremely confident**
1. Identify a clinical problem needing evidence to guide patient care	0	1	2	3	4	5	6	7	8	9	10
2. Generate a clinical question from a problem requiring evidence	0	1	2	3	4	5	6	7	8	9	10
3. Identify gaps in the knowledge under-pinning my own professional practice	0	1	2	3	4	5	6	7	8	9	10
4. Clearly and succinctly define the clinical problem requiring evidence	0	1	2	3	4	5	6	7	8	9	10
5. Determine what I know and don't know about the problem	0	1	2	3	4	5	6	7	8	9	10
6. Use computers to search for evidence-based information	0	1	2	3	4	5	6	7	8	9	10
7. Identify key words, subjects and/or concepts to guide the search for information	0	1	2	3	4	5	6	7	8	9	10
8. Locate local and/or on-site information resources to be able to conduct research (e.g., library and computer resources)	0	1	2	3	4	5	6	7	8	9	10

How <u>confident</u> are you in your ability to successfully accomplish each of the following activities?	**No confidence at all**					**Somewhat confident**					**Extremely confident**
9. Conduct a literature search on my own using bibliographic data bases e.g., MEDLINE, CINAHL	0	1	2	3	4	5	6	7	8	9	10
10. Conduct a literature search on my own using other sources of important evidence-based information e.g., Cochrane Library, Joanna Briggs Institute	0	1	2	3	4	5	6	7	8	9	10
11. Locate appropriate online guidelines (e.g., NICE, NGC, NHS)	0	1	2	3	4	5	6	7	8	9	10
12. Seek assistance when necessary from librarian personnel and/or research staff to help with the search for evidence	0	1	2	3	4	5	6	7	8	9	10
13. Retrieve and organise the saving of relevant search information on the computer	0	1	2	3	4	5	6	7	8	9	10
14. Read systematic reviews	0	1	2	3	4	5	6	7	8	9	10
15. Critically appraise the quality of the evidence	0	1	2	3	4	5	6	7	8	9	10
16. Assess the applicability (usefulness in own clinical practice) of the evidence	0	1	2	3	4	5	6	7	8	9	10
17. Assess the impact of the evidence (i.e., the size of the effect)	0	1	2	3	4	5	6	7	8	9	10
18. Determine the levels of evidence	0	1	2	3	4	5	6	7	8	9	10
19. Distinguish between research evidence and expert opinion	0	1	2	3	4	5	6	7	8	9	10
20. Recognise gaps in the evidence	0	1	2	3	4	5	6	7	8	9	10
21. Use evidence in my clinical practice and decision making about an individual patient's care according to their circumstances	0	1	2	3	4	5	6	7	8	9	10

How <u>confident</u> are you in your ability to successfully accomplish each of the following activities?	**No confidence at all**					**Somewhat confident**					**Extremely confident**
22. Incorporate evidence into policies	0	1	2	3	4	5	6	7	8	9	10
23. Participate in the development of evidence-based guidelines or clinical policy	0	1	2	3	4	5	6	7	8	9	10
24. Share evidence and related information with colleagues	0	1	2	3	4	5	6	7	8	9	10
25. Identify criteria to use for auditing my/others' practice to determine the level of adherence to evidence-based practice	0	1	2	3	4	5	6	7	8	9	10
26. Collect audit data about my/others' practice to determine level of adherence to evidence-based practice	0	1	2	3	4	5	6	7	8	9	10
27. Evaluate the efficiency and economic impacts of evidence-based change in practice	0	1	2	3	4	5	6	7	8	9	10
28. Evaluate the impact of my/others' EBP practice on patient health outcomes and satisfaction	0	1	2	3	4	5	6	7	8	9	10

Appendix K

Measurement scale for Stage 2: Outcome expectations of Evidence-Based Practice (EBP)

Adapted from Chang, A.M., & Crowe, L.M. (2012). *Self-efficacy in Evidence-Based Practice Activities – Beta Version Manual*. Queensland University of Technology. Brisbane: Australia– Permission has been obtained from the primary author

For the next questions, please rate how **confident** you are that successful accomplishment of each of the following activities will lead to the desired outcome. Each activity with its desired outcome is related to practicing evidence-based healthcare. In the boxes provided to the right of each activity, please indicate (by circling one number on each line) your degree of confidence, from 0 (no confidence at all) to 10 (extremely confident).

How confident are you that accomplishing the following activities will lead to the stated outcome?	**No confidence at all**					**Somewhat confident**					**Extremely confident**
1. Stating a clear definition of the clinical problem requiring evidence will make it easier for me to search for evidence	0	1	2	3	4	5	6	7	8	9	10
2. Finding the evidence will lead to higher quality work in my clinical care	0	1	2	3	4	5	6	7	8	9	10
3. Assessing the levels of evidence will improve my use of evidence in clinical care	0	1	2	3	4	5	6	7	8	9	10
4. Critically appraising systematic reviews of evidence will enable me to select higher quality evidence to guide my clinical care	0	1	2	3	4	5	6	7	8	9	10
5. Appraising evidence will assist me to produce higher quality policies/guidelines	0	1	2	3	4	5	6	7	8	9	10

How **confident** are you that accomplishing the following activities will lead to the stated outcome?	**No confidence at all**					**Somewhat confident**					**Extremely confident**
6. Applying evidence into practice will lead to higher quality of work in my clinical care	0	1	2	3	4	5	6	7	8	9	10
7. Participating in the development of evidence-based policy/practice guidelines leads to a feeling of achievement	0	1	2	3	4	5	6	7	8	9	10
8. Evaluating the effectiveness of my evidence-based practice will enable me to achieve better patient outcomes	0	1	2	3	4	5	6	7	8	9	10

Appendix L

Measurement scale for Stage 2: EBP Current use

Adapted from Chang, A.M., & Crowe, L.M. (2012). *Self-efficacy in Evidence-Based Practice Activities – Beta Version Manual.* Queensland University of Technology. Brisbane: Australia– Permission obtained from the primary author

For the following items we are interested to know about **your use of evidence in your clinical practice experiences**. Please circle the number most closely representing the frequency you have used the following evidence-based practice activities:

0 = Never and 7 = Frequently

	Never							Frequently
During the **past 6 months**, how frequently have you:								
1. Practiced evidence-based nursing in relation to an individual patient's care?	0	1	2	3	4	5	6	7
2. Identified a clinical problem needing evidence to guide nursing care in relation to an individual patient's care?	0	1	2	3	4	5	6	7
3. Generated a clinical question from a problem requiring evidence in relation to an individual patient's care?	0	1	2	3	4	5	6	7
4. Tracked down the best evidence with which to answer that question in relation to an individual patient's care?	0	1	2	3	4	5	6	7
5. Critically appraised the quality of the evidence in relation to an individual patient's care?	0	1	2	3	4	5	6	7
6. Applied the evidence into your own practice and clinical decision-making in relation to an individual patient's care?	0	1	2	3	4	5	6	7
7. Measured the outcomes of your evidence-based practice in relation to an individual patient's care?	0	1	2	3	4	5	6	7
8. Shared evidence with colleagues in relation to an individual patient's care?	0	1	2	3	4	5	6	7

Appendix M

Permissions for Use of measurement scales

Scale for measuring Intention to use EBP following graduation (16/6-15)

Dear Mary-Anne,
Feel free to use the scale. We appreciate that you write about the origin of the scale in your work and sending us a copy of the paper where you present results. Wish you good luck in your PhD work.
Best regards
Lars

Skickat från min iPad

15 jun 2015 kl. 09:54 skrev Mary-Anne Ramis <m.ramis@qut.edu.au>:

Dear Dr Wallin,

The email I sent below bounced back to me as I must have made an error with the mail address. I used the address from your publication (2012) so it may not be current.

Hopefully this one will reach you.

Thank you again for consideration of my request to use the scale.

Kind regards,
Mary-Anne.

From: Mary-Anne Ramis
Sent: Monday, 15 June 2015 5:36 PM
To: 'lars.wallin@karolinska.se'; 'Anne-Marie.Bostrom@ki.se'
Subject: permission to use scale

Dear Dr Wallin and Dr Bostrom,

I am seeking permission to use the 6-item scale as published in the article/s:
Wallin, L., Boström, A.-M. and Gustavsson, J. P. (2012), Capability Beliefs Regarding Evidence-Based Practice are Associated with Application of EBP and Research Use: Validation of a New Measure. Worldviews on Evidence-Based Nursing, 9: 139–148. doi: 10.1111/j.1741-6787.2012.00248.x

Boström, A. M., Rudman, A., Ehrenberg, A., Gustavsson, J. P., & Wallin, L. (2013). Factors associated with evidence-based practice among registered nurses in Sweden: A national cross-sectional study. BMC Health Services Research, 13(1). doi: 10.1186/1472-6963-13-165

I am PhD student and as part of my research I am investigating EBP development of undergraduate students across different health disciplines. I am developing a prediction model and would like to use your scale as a measurement of the outcome variable of 'intention to practice EBP'. This would require adding in the wording of, "After graduation, I intend to…" This would then be followed by the six items and the 4 point Likert response scale for each item. My model is also based on Bandura's self-efficacy theory.

As the scale captures all the steps of the EBP process I feel it would be very useful for this aspect of my study. I would be sure to reference the scale appropriately and would be happy to send you any publications arising for the research.

Thank you for your time and consideration of my request.

Kind regards,

Mary-Anne.

Mary-Anne Ramis RN BN MPhil (Clinical Sciences) PhD Candidate
Research Assistant | Centre for Evidence Based Healthy Ageing (CEBHA)
Queensland University of Technology | Room N314, Level 3, N Block, Kelvin Grove Campus, QLD, 4059
Ph: +61 7 3138 3903 | m.ramis@qut.edu.au

Sources of Self-efficacy scale (14/4/15)

Hello Mary-Anne,

See attached file for the instrument. Maybe you have to adjust it.

Kind regards,

Met vriendelijke groeten,

Dr. Henk Gloudemans
Teamleider Zorginnovatiecentra - Lid lectoraat FHV
Fontys Hogeschool Verpleegkunde
T. 06-29217324

Van: Mary-Anne Ramis [mailto:m.ramis@qut.edu.au]
Verzonden: dinsdag 14 april 2015 2:44
Aan: Gloudemans,Henk H.A.
Onderwerp: RE: self-efficacy tool

Dear Dr Gloudemans,

Thank you very much for your reply. I do think the model will provide some very informative data. I plan to include nursing and paramedicine students in my data collection so I can compare sources of self-efficacy in the clinical education environments, for the different populations.

I was wondering if you have a version of the 22 item, five factor tool that I would be able to reference and use? I have the paper which outlines the development and conceptual blueprint but not the actual tool.

Thank you for your help,
Kind regards,
Mary-Anne.

From: Gloudemans,Henk H.A. [mailto:h.gloudemans@fontys.nl]
Sent: Monday, 13 April 2015 6:31 PM
To: Mary-Anne Ramis
Subject: RE: self-efficacy tool

Hello Mary-Anne,

Feel free to use the model! The model explains how students learn, based on Bandura's sources of self-efficacy. I defined the model as an intermediate in learning. The questionnaire itself is a general instrument which is applicable (with some adjustments maybe) in a broad variety of nursing educational contexts. I believe you can use it as a basis in your research to predict the use of EBP after graduation.

Good luck and kind regards,

Met vriendelijke groeten,

Dr. Henk Gloudemans
Teamleider Zorginnovatiecentra - Lid lectoraat FHV
Fontys Hogeschool Verpleegkunde
T. 06-29217324

Van: Mary-Anne Ramis [mailto:m.ramis@qut.edu.au]
Verzonden: maandag 13 april 2015 9:31
Aan: Gloudemans,Henk H.A.
Onderwerp: self-efficacy tool

Dear Dr Gloudemans,

I am writing to seek permission to use the self-efficacy model that you have reported on, in "The development and validation of a five-factor model of Sources of Self-Efficacy in clinical nursing education".

I am a current PhD student and my study is focusing on developing evidence-based practice behaviours in undergraduate health students, with a focus on Bandura's self-efficacy theory. As part of my studies, I am developing a prediction model for intention to use EBP after graduation, and I have been looking for a validated tool that measures sources of self-efficacy in their educational environment. I believe that your model would be appropriate for this.

Could you please advise if it would be possible to use the model? I would ensure to adhere to copyright conventions and would keep you notified of my results and any publications arising from the study.

Thank you for your time and any advice,

Kind regards,
Mary-Anne.

Mary-Anne Ramis RN BN MPhil (Clinical Sciences) PhD Candidate
Research Assistant | Centre for Evidence Based Healthy Ageing (CEBHA)
Queensland University of Technology | Room N314, Level 3, N Block, Kelvin Grove Campus, QLD, 4059
Ph: +61 7 3138 3903 | m.ramis@qut.edu.au

EBP Beliefs Scale (7/4/15)

HI Mary-Anne. You are all set – thank you! Attached please find the EBPB for the sole use in your PhD dissertation.

If you have a future project for which our scales are matches, please contact me and we will work out the permissions as they are project by project permissions.

Wishing you the very best,
Ellen

Ellen Fineout-Overholt PhD, RN, FNAP, FAAN
Partner & General Manager, ARCC llc
ellen.fineout.overholt@gmail.com

From: Mary-Anne Ramis [mailto:m.ramis@qut.edu.au]
Sent: Friday, March 27, 2015 6:10 PM
To: Ellen Fineout-Overholt
Subject: Fw: permission to use EBP beliefs scale

Dear Professor Fineout-Overholt,

I am just following up from my email earlier this month to check if there is any further information you require from me in relation to using the EBP Beliefs scale.

I have reattached the IP agreement but please let me know if there is anything that needs further amendment.

Thank you for your time,

Kind regards,

Mary-Anne.

Mary-Anne Ramis RN BN MPhil (Clinical Science) PhD Candidate
Research Assistant, Centre for Evidence Based Healthy Ageing (CEBHA),
Room N314, N Block
Queensland University of Technology
School of Nursing
Kelvin Grove, Qld 4059
Email: m.ramis@qut.edu.au
Ph: (07) 3138 3903

From: Mary-Anne Ramis
Sent: Monday, March 02, 2015 4:26 PM
To: Ellen Fineout-Overholt
Subject: Re: permission to use EBP beliefs scale

Dear Professor Fineout-Overholt,

My apologies for the delay in getting this from back to you.

On advice from our business manager, I have signed the form in my capacity as a PhD student, as the scale will only be used by me, for this component of my PhD study.

I will ensure to send you the version of the tool in it's online format prior to any distribution for data collection as well as any drafts of publications that may arise from my research.

I will also ensure it is correctly referenced and cited.

Thank you for the opportunity to use your scale - it will provide valuable data for informing my study.

Kind Regards,
Mary-Anne.

Mary-Anne Ramis RN BN MPhil (Clinical Science) PhD Candidate
Research Assistant, Centre for Evidence Based healthy Ageing (CEBHA)
Room N314, N Block
Queensland University of Technology
School of Nursing
Kelvin Grove, Qld 4059
Email: m.ramis@qut.edu.au
Ph: (07) 3138 3903

From: Ellen Fineout-Overholt <ellen.fineout.overholt@gmail.com>
Sent: Sunday, February 01, 2015 1:22 AM
To: Mary-Anne Ramis
Subject: RE: permission to use EBP beliefs scale

HI Mary-Anne. With international students, we require an intellectual property (IP) agreement for those who want to use collect the data electronically versus our usual required online surveys. Given that you are conducting your survey online, please complete the attached IP agreement, sign, scan and return. Unfortunately, we cannot accept an electronic signature for this document.

As always, please let me know of any questions. Once I receive the IP agreement, I will send along the scale. I apologize for the inconvenience.

All the best,
Ellen

Ellen Fineout-Overholt PhD, RN, FNAP, FAAN
Partner & General Manager, ARCC llc
ellen.fineout.overholt@gmail.com

From: Mary-Anne Ramis [mailto:m.ramis@qut.edu.au]
Sent: Wednesday, January 21, 2015 9:41 PM
To: Ellen Fineout-Overholt
Cc: Anne Chang
Subject: Re: permission to use EBP beliefs scale

Dear Professor Fineout-Overholt,

Please find attached the permission form for the beliefs scale.

I do need to clarify with you about using the scale electronically as we had planned to use an online survey.

As the form specifies electronic data collection is not permitted I wondered if this would negate our ability to use the scale?

The survey would be created using QUT key survey methods and would be distributed according to QUT's Information privacy policy and the scale would be cited and referenced appropriately.

I would be happy to provide any further information as required.

Thank you.

Kind Regards,
Mary-Anne.

Mary-Anne Ramis RN BN MPhil (Clinical Science) PhD Candidate
Research Assistant, Centre for Evidence Based Healthy Ageing (CEBHA,
Room N314, N Block
Queensland University of Technology
School of Nursing
Kelvin Grove, Qld 4059
Email: m.ramis@qut.edu.au
Ph: (07) 3138 3903

From: Ellen Fineout-Overholt <ellen.fineout.overholt@gmail.com>
Sent: Wednesday, January 14, 2015 1:11 AM

To: Mary-Anne Ramis
Subject: RE: permission to use EBP beliefs scale

HI Mary-Anne. Thank you for your email and follow-up. Great to hear of your work – looking forward to the results of you project!!

Attached please find the permission forms for student use of the EBPB scale in an single academic project. Given that you are an international student, our current policy is to offer this use gratis. Please let me know of any questions. We very much appreciate the receipt of psychometric information for the scale as well as demographics for your population.

We always appreciate any questions you may have, so please feel free to send along.

Once you send me the completed, signed form, I will send the EBPB via email.

Wishing you the best,
Ellen

Ellen Fineout-Overholt PhD, RN, FNAP, FAAN
Partner & General Manager, ARCC llc
ellen.fineout.overholt@gmail.com

From: Mary-Anne Ramis [mailto:m.ramis@qut.edu.au]
Sent: Monday, January 12, 2015 10:44 PM
To: lfineout@uttyler.edu
Cc: ellen.fineout.overholt@gmail.com
Subject: FW: permission to use EBP beliefs scale

Dear Dr Fineout-Overholt,

I contacted Professor Melnyk last month in regard to permission for using the EBP Beliefs scale as published in: Melnyk, B. M., Fineout-Overholt, E., & Mays, M. Z. (2008). The Evidence-Based Practice Beliefs and Implementation Scales: Psychometric Properties of Two New Instruments. Worldviews on Evidence-Based Nursing, 5(4), 208-216.

Professor Melnyk advised me that you organise permissions for the scale, so I thought I should follow up with you.

I am a PhD student in Brisbane, Australia and am investigating undergraduate health students self-efficacy in EBP. I would like to use the EBP Beliefs Scale as part of a descriptive study, with a view to create a prediction model for intention to use EBP.

Thank you for your time - any information regarding use of the scale would be gratefully appreciated.

Kind Regards,
Mary-Anne.

Mary-Anne Ramis RN BN MPhil (Clinical Sciences) PhD Candidate
Research Assistant | Centre for Evidence Based Healthy Ageing (CEBHA)

Queensland University of Technology | Room N314, Level 3, N Wing, Kelvin Grove Campus, QLD, 4059
Ph: +61 7 3138 3903 | m.ramis@qut.edu.au

From: Melnyk, Bernadette [mailto:melnyk.15@osu.edu]
Sent: Friday, 5 December 2014 12:20 AM
To: Mary-Anne Ramis
Cc: Anne Chang; 'Ellen (ellen.fineout.overholt@gmail.com)'
Subject: RE: permission to use EBP beliefs scale

Hi Mary-Anne,

It is great to hear from you and about your interest in our scale.
My colleague, Ellen, handles all of these requests and will be sending you the information.
Best wishes!

Warm and well regards,
Bern
Bernadette Mazurek Melnyk, PhD, RN, CPNP/PMHNP, FAANP, FNAP, FAAN
THE OHIO STATE UNIVERSITY

Associate Vice President for Health Promotion
University Chief Wellness Officer
Dean and Professor, College of Nursing
Professor of Pediatrics & Psychiatry, College of Medicine
The Ohio State University
145 Newton Hall | 1585 Neil Avenue Columbus, OH 43210
614-292-4844 Office
melnyk.15@osu.edu
BernMelnyk@twitter.com
http://millionhearts.hhs.gov/index.html

From: Mary-Anne Ramis [mailto:m.ramis@qut.edu.au]
Sent: Wednesday, December 03, 2014 8:36 PM
To: Melnyk, Bernadette
Cc: Anne Chang
Subject: permission to use EBP beliefs scale

Dear Professor Melynk,

I am writing to ask permission to use the EBP Beliefs Scale that you developed, as published in:
Melnyk, B. M., Fineout-Overholt, E., & Mays, M. Z. (2008). The Evidence-Based Practice Beliefs and Implementation Scales: Psychometric Properties of Two New Instruments. Worldviews on Evidence-Based Nursing, 5(4), 208-216.

I am conducting a study as part of my PhD looking at undergraduate self-efficacy for EBP but would like to also examine any association between EBP beliefs and EBP self-efficacy and require a validated tool for the EBP Beliefs measures. I will be sampling two cohorts of nursing and clinical science students.

Thank you,
Kind regards,

Mary-Anne.

Mary-Anne Ramis RN BN MPhil (Clinical Science) PhD Candidate
Research Assistant, Centre for Evidence Based Healthy Ageing (CEBHA),
Room N314, N Block
Queensland University of Technology
School of Nursing
Kelvin Grove, Qld 4059
Email: m.ramis@qut.edu.au
Ph: (07) 3138 3903

Appendix N

Data management plan

Name: development of Evidence-based practice behaviours in Undergraduate health students
DMP Identifier: 943
Project title: Development of Evidence-based practice behaviours in Undergraduate health students
Principal investigator: Mary-Anne Ramis

Data management plan creator: Mary-Anne Ramis

1.1 Research project name *
Development of Evidence-based practice behaviours in Undergraduate health students

1.2 Version
Version 1.1

1.3 Chief Investigator / researcher *
Mary-Anne Ramis

1.4 ORCiD
0000-0001-9453-9565

1.5 Research team members *
Prof Anne M. Chang (Supervisor)
Prof Lisa Nissen (Supervisor)

1.6 QUT affiliations *
Faculty of Health

1.7 Other affiliations
Centre for Evidence Based Healthy Ageing

1.8 Project contact regarding data management *
Mary-Anne Ramis
E: m.ramis@qut.edu.au
Ph. 07 3138 3903

1.9 Description of the project *
For many health disciplines, undergraduate students are required to incorporate evidence-based practice skills and knowledge into their clinical decision-making and professional practice, as mandated by registration requirements. Despite this requirement, previous research relating to evidence-based practice behaviour has predominantly focused on

health professionals and on changing behaviour to improve evidence implementation, rather than instilling and developing behaviours in the first instance. This research will investigate factors that influence undergraduate students' development of evidence–based practice behaviours and subsequent intention to use EBP after graduation, through development and testing of a multivariate prediction model.

1.10 Funding bodies, grant and other reference IDs
N/A

1.11 Research areas
119999 - Medical and Health Sciences not elsewhere classified; 130209 Medicine, Nursing and Health Curriculum and Pedagogy

1.12 Research ethics clearances
QUT HREC Approval 1500000605
End Date: 29/07/2018

2.1 Existing datasets
There are no existing datasets for this project.

2.2 Data description
Quantitative data will be collected via online questionnaire/survey. The questionnaire will be developed using Key Survey, which is an online questionnaire development and support service exclusively for QUT staff and higher degree research students (http://survey.qut.edu.au/site/). The service complies with QUT's privacy policy and respondent's anonymity will be assured. The questionnaires have been developed from research tools used in other studies. Permission has been obtained to use the tools, where necessary. Respondents will enter data online, which will then be exported, directly to an IBM SPSS™ (Statistical Package for the Social Sciences) or CVS file for analysis.

2.3 Data collection procedures
After ethical approvals are obtained, the first data sample will be determined. Data will be collected from undergraduate students in the School of Nursing and School of Clinical Sciences, as these schools form two of the larger health schools within the Faculty of Health at QUT and students have extensive opportunities for clinical experience during which EBP skills are taught and required. Two episodes of data collection will be undertaken. Data collected from the first survey will be used for the derivation of the initial prediction model. The second round of data collection will be used to test the refined model. Testing the model with an independent dataset is recommended as the most rigorous form of model assessment and is likened as a method of external validation (Bouwmeester et al., 2012). A short demographic questionnaire will be developed to collect information pertaining to student year level, course being studied and any prior EBP experience. Other data collection instruments include:
Generic EBP knowledge tool (Chang & Crowe, 2011)
EBP Beliefs Scale (Melnyk and Fineout-Overholt, 2004)
Self-Efficacy for Evidence Based Practice (SE-EBP) scale (Chang & Crowe, 2012)
Outcome Expectancy for Evidence Based Practice Scale (Chang & Crowe, 2011)
Five-factor Sources of Self-Efficacy model (Gloudemans et al., 2012)

Intention to use EBP following graduation (original tool by Bostrom et al., 2013 & Wallin et al., 2012)
All permissions have been obtained from the authors.

2.4 Quality control procedures
Data will be cleaned and checked for completeness and any out-of-range responses prior to analysis. Statistical analysis of frequencies, means and ranges will be conducted as part of the data checking process.

2.5 Data organisation
The master data file will be named RAW_EBP_Master_DDMMYY.sps. Data will be analysed using IBM SPSS™ and IBM AMOS™ software programs and files will be recognisable using the file extensions of .sps, .spv and .amw. Some data may be transformed to visual graphics using the AMOS software and these will be saved as .pdf or .jpeg files.
The TILS document naming convention will be used for any other files pertaining to data collection.

2.6 Expected volume of data
We anticipate approximately 400 survey responses over the course of the survey, which will not require any extra data storage.

2.7 Start date of data collection *
2016-03-31

2.8 End date of data collection *
2016-09-30

3.1 Data privacy
The main on-line questionnaire has been developed using Key Questionnaire software, which is endorsed for use by QUT. The software allows for individual responses to be submitted anonymously and has the capability to attach a separate page where they can enter an email address to enter the prize draw. Participants' email addresses are not linked to the data collected and will be sent to the researcher as a separate report from the data collected. The prize draw will be randomly selected from the list of email addresses and the winner of the voucher will be notified via email. No identification details will be recorded by participants. An email link will be used for participants but the respondents email address will not be linked to their data. Submitting the completed online questionnaire is accepted as an indication of the participants' consent to participate in this project.

3.2 Data confidentiality
Any data collected as part of this project will be stored securely as per QUT's management of research data policy. Data will be password protected. The office where the data is stored is locked and the computer which the data will be stored on is password protected. Only the Chief Investigator and the School of Nursing Administrative Officer has access to the office. All comments and responses are anonymous and will be treated confidentially unless required by law. The names of individual persons are not required in

any of the responses. Non-identifiable data collected in this project may be used as comparative data in future projects or stored on an open access database for secondary analysis.

3.3 Data ownership and intellectual property
Intellectual property will be owned by the Chief Investigator (Ramis) as part of her higher degree research

3.4 Copyright
Copyright of the data will be owned by the Chief Investigator, as part of her higher degree research. A copyright agreement has been signed for one of the data collection instruments (Melnyk et al., 2004) and instructions regarding this have been taken into consideration when designing the online collection instrument.

3.5 Funding body and other stakeholder requirements
No other funding bodies are involved in this research.

4.1 Data storage
Data will be stored on the researcher's work computer and backed up on the QUT secure network. Copies of the main master file will be kept on an external hard drive also (USB), only accessible to the primary researcher. Data will be controlled through use of a password, which the primary investigator will determine. Only the primary investigator will be able to access the stored data. If there are any technical problems with the network an IT administrator may be able to access the data but they will require permission from the primary investigator.

4.2 Data loss prevention procedures
As the files will be stored on QUT networks, they will automatically be backed up which assist to prevent data loss. A copy of the master file will also be kept by the chief researcher on an external hard drive (USB), which will be kept in a secure location off campus.

4.3 Data access
As the data is de-identified no extra security measures are envisioned, other than those mentioned above. We will not use Cloud storage for the data. The chief researcher will have primary access to the data but if supervisors request a copy, it will be personally delivered to them and downloaded from the USB to their own secure computer, which will be password protected.

4.4 Data transmission procedures
As the data is de-identified we do not foresee any situations requiring data encryption. If any such situation should arise, we would consult immediately with QUT's High Performance Computing and Research support team for guidance.

5.1 Preservation plan
Data will be retained by the chief investigator and will be maintained according to QUT policy. If the data needs to be destroyed it will be done so according to secure data disposal methods as advocated by QUT policy.

5.2 Estimated costs
No extra cost is anticipated with this project. The researcher will be able to consult with supervisors or attend free workshops to assist with any data analysis concerns, as well as consult with statisticians at QUT if required.

5.3 Retention period and disposal plan
Data will be disposed of according to QUT policy. As there is no identifiable data, there is no need for extra special requirements.

5.4 Date of data retention review
2017-06-30

6.1 Method for data sharing
As data collected will be part of a PhD study, it is not anticipated that the data will need to be shared. However, if requested by other researchers, the chief investigator will organise sharing the de-identified data according to QUT policy. Advice will be obtained from QUT library research support team if there are any requests for data to be shared.

6.2 Restrictions on sharing and access procedures
There are no foreseen restrictions on sharing the deidentified data, however results from the study will be published in international journals consequently, there may be some requests for further information or data access. Any such requests will be handled in a case-by-case manner, following advice and consultation with supervisors and QUT library research support staff.

6.3 Documentation
A coding manual will be created for data analysis to describe the variables and labels used for data collection. Description of the populations being studied will also be included in the manual to provide contextual information.

6.4 Metadata
Metadata related to this study will include the data coding manual, ethics applications, copyright and instructions for using the data collection tools, permissions for use of data collection instruments, references and copies of data files and written documents. All electronic metadata will be stored according to the QUT guidelines for management of research data and the chief investigator will be responsible for ensuring the information is stored appropriately.

7.1 Next DMP review date *
2016-06-30

7.2 Declarations
This plan is in compliance with:
- QUT MOPP D/2.8 Management of research data
- Australian Code for the Responsible Conduct of Research
- University and/or statutory requirements, guidelines and codes of practice.

The information contained in this form is true and accurate.

All investigators, students, supervisors and assistants this plan is shared with (see 'Share' tab) will be able to access a copy of the plan.

Signature ________________________________ Date ________________________
Print name ___________________ Role/institution ___________________________
Signature ________________________________ Date ________________________
Print name ___________________ Role/institution ___________________________

Signature ________________________________ Date ________________________
Print name ___________________ Role/institution ___________________________

Appendix O

Copy of Research Ethics Approval Email

From: QUT Research Ethics Unit
Sent: Monday, 3 August 2015 1:57 PM
To: Anne Chang; Mary-Anne Ramis; Lisa Nissen
Cc: Deborah Smith

Subject: Ethics application - approved – 1500000605

Dear Prof Anne Chang and Mrs Mary-Anne Ramis

Project Title: Factors influencing the development of undergraduate health students' evidence-based practice behaviours
Ethics Category: Human - Low Risk
Approval Number: 1500000605
Approved Until: 29/07/2018
(subject to receipt of satisfactory progress reports)
We are pleased to advise that your application has been reviewed and confirmed as meeting the requirements of the National Statement on Ethical Conduct in Human Research.

I can therefore confirm that your application is APPROVED.

If you require a formal approval certificate please advise via reply email.

CONDITIONS OF APPROVAL
Please ensure you and all other team members read through and understand all UHREC conditions of approval prior to commencing any data collection:
> Standard: Please see attached or go to
http://www.orei.qut.edu.au/human/stdconditions.jsp
> Specific: None apply
Decisions related to low risk ethical review are subject to ratification at the next available UHREC meeting. You will only be contacted again in relation to this matter if UHREC raises any additional questions or concerns.

Whilst the data collection of your project has received QUT ethical clearance, the decision to commence and authority to commence may be dependent on factors beyond the remit of the QUT ethics review process. For example, your research may need ethics clearance from other organisations or permissions from other organisations to access staff. Therefore the proposed data collection should not commence until you have satisfied these requirements.

Please don't hesitate to contact us if you have any queries.
We wish you all the best with your research.

Kind regards

Janette Lamb on behalf of Chair UHREC
Office of Research Ethics & Integrity
Level 4 | 88 Musk Avenue | Kelvin Grove
p: +61 7 3138 5123
e: ethicscontact@qut.edu.au
w: http://www.orei.qut.edu.au

Appendix P

Participant information sheet for survey

Queensland University of Technology Brisbane Australia	**PARTICIPANT INFORMATION FOR QUT RESEARCH PROJECT – Questionnaire –**
FACTORS INFLUENCING THE DEVELOPMENT OF UNDERGRADUATE HEALTH STUDENTS' EVIDENCE-BASED PRACTICE BEHAVIOURS **QUT Ethics Approval Number 1500000605**	

Research Team

Principal Researcher:	Mary-Anne Ramis, RN, BN, MPhil (Clinical Sciences), PhD candidate, School of Nursing, QUT
Associate Researcher:	Professor Anne Chang, PhD, School of Nursing, Faculty of Health Queensland University of Technology (QUT) Professor Lisa Nissen, PhD, Head of School, School of Clinical Sciences, Faculty of Health. Queensland University of Technology (QUT)

Description

This project is being undertaken as part of PhD for Mary-Anne Ramis.

The purpose of this project is to gather information relating to how undergraduate students from different health disciplines develop their knowledge of evidence-based practice (EBP). More specifically, we are looking at factors that may affect development of EBP such as EBP knowledge, behaviour, attitudes, self-efficacy and your intention to use EBP after graduation.
You are invited to participate in this project because you are studying a health discipline that requires some EBP criteria be met for professional registration, after graduation. Looking at ways that students develop these behaviours during their study period will help to identify ways that curriculum can support EBP development.

Participation

Participation will involve completing an anonymous questionnaire comprising seven (7) tools with between 6 and 28 questions in each. A short demographic questionnaire is also included. Most tools have a Likert scale for your responses (e.g. strongly agree – strongly disagree), or a 10 point scale rating, but one tool uses multiple choice format. It will take approximately 20-30 minutes of your time to complete the questionnaire.

Questions will include: How confident are you in your ability to successfully accomplish of the following activities?
During the last six months (or your last clinical practice) how frequently have you used evidence-based practice in relation to an individual patient's care?

Your participation in this project is entirely voluntary. If you agree to participate you do not have to complete any question(s) you are uncomfortable answering. Your decision to participate or not participate will in no way impact upon your current or future relationship with QUT. Your grades will not be affected by either doing this survey or not doing it. Even if you do agree to participate you can withdraw from the project without comment or penalty. No identifiable information is anticipated, if any identifiable information is obtained it will be destroyed. However as the questionnaire is anonymous once it has been submitted it will not be possible to withdraw.

Expected benefits

It is expected that this project will not directly benefit you. However, it may benefit those planning curricula for undergraduate health students, specifically in relation to developing students' evidence-based practice.

To recognise your contribution, should you choose to participate; the research team is offering participants the chance to win a $100 gift voucher from a major grocery chain. To enter the prize draw you need to complete the initial survey and then follow the directions to the prize draw page. The prize draw will be conducted by someone other than the research team and the winner will be notified by email.

Risks

There are minimal risks associated with your participation in this project. The anticipated risk of inconvenience at the time required to complete the questionnaire may be minimized by doing so at a time of your choice, when it is convenient to you. You are under no pressure to participate and can withdraw at any time, without penalty. If you agree to participate, you have up to one week to complete the questionnaire and can stop and start the questionnaire at any time during the week. If you have already engaged in other online surveys, you can choose not to participate in this one. Please be assured that if you do complete the survey your responses will be anonymous and will in no way impact on your studies or grades.

Privacy and confidentiality

All comments and responses are anonymous and will be treated confidentially unless required by law. The names of individual persons are not required in any of the responses.

Any data collected as part of this project will be stored securely as per QUT's Management of research data policy.

Please note that non-identifiable data collected in this project may be used as comparative data in future projects or stored on an open access database for secondary analysis.

Consent to Participate

Submitting the completed online questionnaire is accepted as an indication of your consent to participate in this project.
Questions / further information about the project
If you have any questions or require further information please contact one of the research team members below.

Name:	Mary-Anne Ramis	Name:	Professor Anne Chang
Phone:	(07) 3138 3903	Phone:	(07) 3138 3842
Email:	m.ramis@qut.edu.au	Email:	am.chang@qut.edu.au

Concerns / complaints regarding the conduct of the project

QUT is committed to research integrity and the ethical conduct of research projects. However, if you do have any concerns or complaints about the ethical conduct of the project you may contact the QUT Research Ethics Unit on [+61 7] 3138 5123 or email ethicscontact@qut.edu.au. The QUT Research Ethics Unit is not connected with the research project and can facilitate a resolution to your concern in an impartial manner.

If you wish to access and complete the survey, please enter the following link into your computer browser:
https://survey.qut.edu.au/f/185058/1593/

Thank you for helping with this research project. Please keep this sheet for your information.